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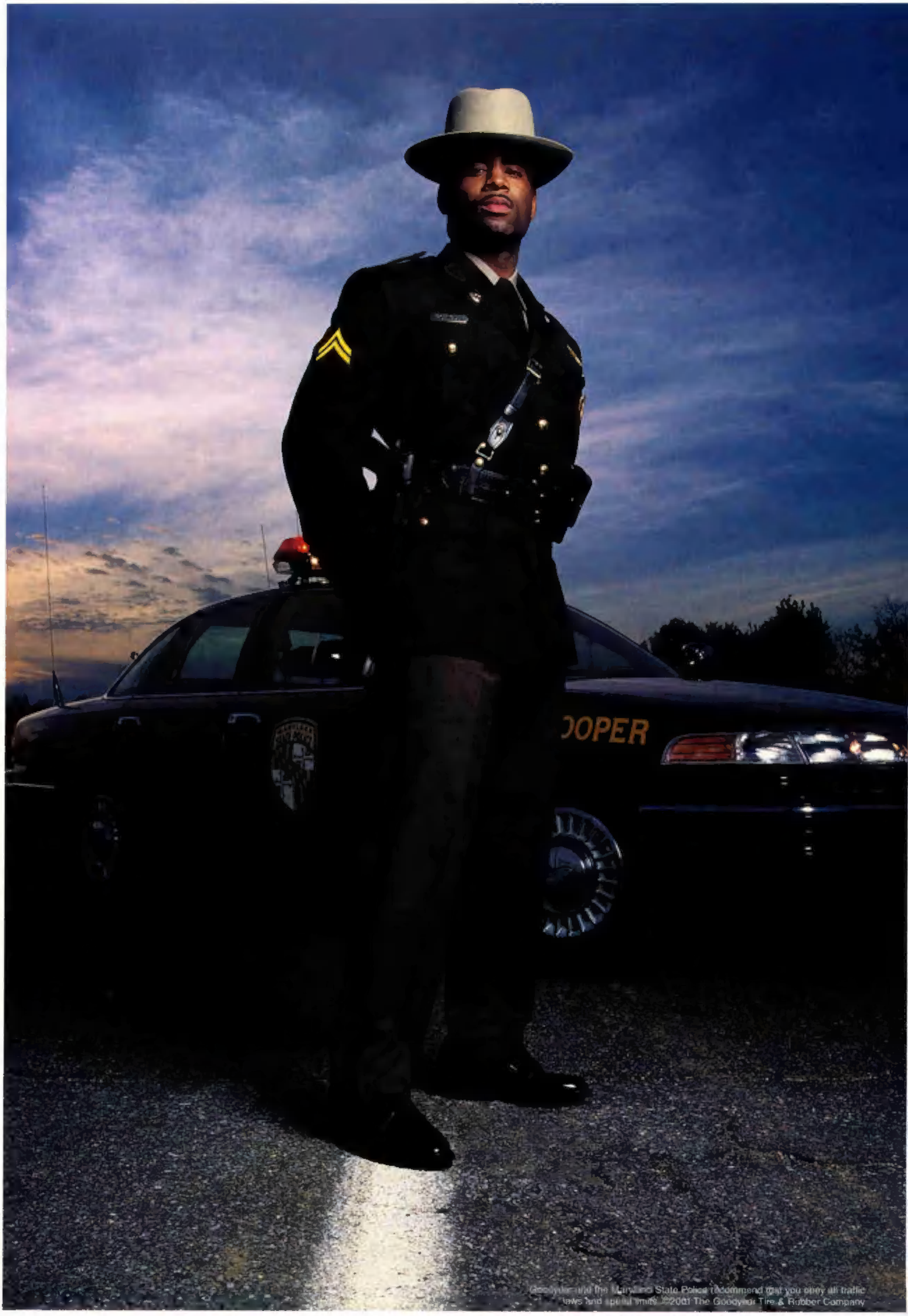
NATIONAL GEOGRAPHIC

Diamonds

The Real Story



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VOL. 201 • NO. 3 • MARCH 2002

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Danube River—62

FEATURES

DEPARTMENTS

THE COVER

A diamond-studded strawberry sparkles with brilliant-cut gems, each with 58 facets. The tiny jewels were cut and polished in Surat, India.
BY CARY WOLINSKY

Cover printed on recycled-content paper

ON THE NGM WEBSITE

nationalgeographic.com/ngm/0203

SIGHTS & SOUNDS See the allure and danger of diamonds.

DIAMONDS How can you spot a fake? What are blood diamonds? Get the answers.

NORTH POLE Listen to a diary of this incredible journey.

WEB-EXCLUSIVE PHOTOS Get tips from the photographers.

From the Editor

The story of how diamonds get to us is just as complicated as the love they've come to symbolize. This month's cover article sheds light on these bright stones—and some of the shady practices behind them.

Did the diamond you admired in that jewelry shop window help finance terrorists? It might have. "Conflict" diamonds, sold or smuggled from places like Angola and the Democratic Republic of the Congo by rebel groups, are funding violence daily in their home countries and abroad. According to the FBI

the diamond trade out of Sierra Leone has pumped millions into Osama bin Laden's al Qaeda network in recent years. Despite United Nations sanctions on such traffic, al Qaeda operatives were able to step up their gem buying last summer, perhaps filling their coffers in anticipation of September 11.

Relatively few of these bloodied stones ever make their way to American retail stores, insist industry officials, who fear backlash from concerned consumers. But once a diamond is cut, it is impossible to know its origins with certainty.

"Buyer beware," says photographer Cary Wolinsky. He shot these four gems—all cut from one 265.82-carat stone—held by dealer William Goldberg (above) but limited himself to a $90 purchase of 110 brilliant-cut diamonds in India. To lend a sense of scale, he studded a strawberry with the gems for the cover photo. "They may be tiny," says Cary, "but there's just something about buying them by the bag."

Bill Allen

TODAY

Mass-produce a hybrid system that reduces smog-forming emissions by up to 90%

TOMORROW

The other 10%

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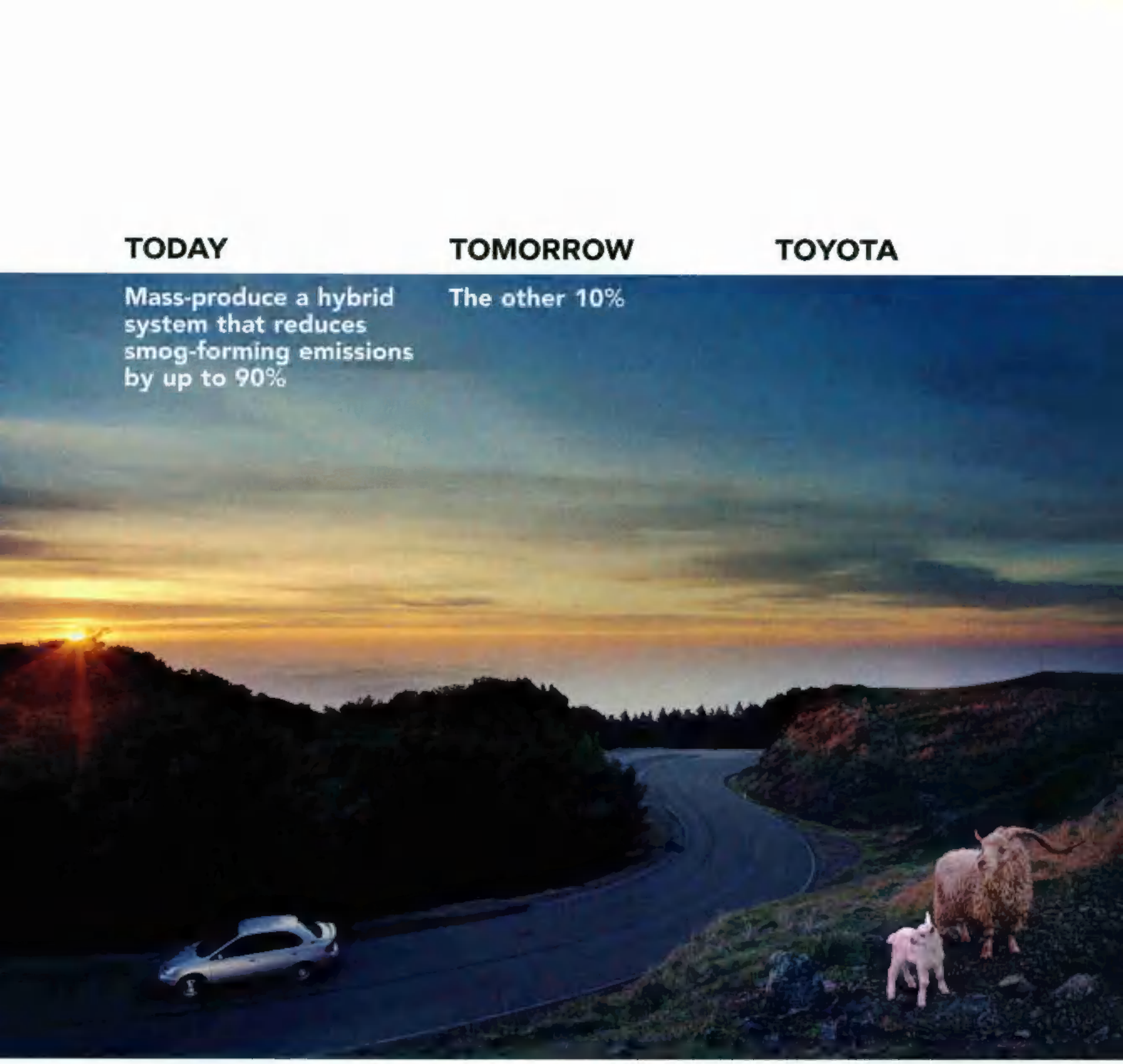

In 1997, Toyota was the first car company to mass-produce a hybrid vehicle. By combining gasoline and electric power, the Prius reduces smog-forming emissions* and cuts gas consumption in half. In short, it has revolutionized the way cars affect our environment.

Now we're road-testing our hydrogen-powered fuel cell hybrid SUV. Its only emission is pure water. Beyond that, who knows. But no matter what, fresh alternatives won't be found overnight. They'll be the result of 90% perspiration. And 10% inspiration.

www.toyota.com/tomorrow

*Based on measurements of hydrocarbons and oxides of nitrogen. Compared to the average car. ©2002

Forum

November 2001

"Russia Rising," on the country's social and economic makeover, drew sympathy from many readers. "Ask the average pensioner if things have really changed for the best, and the answer could be that things were better before the U.S.S.R. dissolved," wrote one. But, said another, though Russians face a difficult transition, they are "intelligent, hardworking people, who, I believe, can pull off the miracle."

King Cobras

Although I was aware that cobras are lightning fast, I had no idea they could grow to such an enormous size. Taking their size, speed, and deadly neurotoxin into consideration, I wondered if a mongoose can actually kill a cobra or is Rudyard Kipling's fabulous Rikki-tikki-tavi a fraud?

KEN LARSEN
Atlanta, Georgia

Rikki-tikki-tavi was an Indian, or gray, mongoose, a species capable of killing cobras, even small king cobras. The mongooses provoke and dodge repeated strikes, then crush the exhausted snake's skull with their jaws.

While I was in Malaysia and Borneo in the 1980s, there were several deaths a year from cobra bites. Most cacao plantations had a flock of geese because they made a terrific, noisy ruckus whenever a snake was present. It was a perfect warning.

MICHAEL J. SCOTT, JR.
Seattle, Washington

Russia Rising

I am a 33-year-old Russian American currently living in Siberia. I saw this article as a serious blow to those who are struggling to give Russia a new face. The older generation's negativity is vexing for the younger generation, which is endeavoring to get past the country's problems. Few countries can claim the natural resources and highly educated population that Russia can. Russia and the 90-plus ethnicities within her borders have endured and, for the most part, survived a revolution and radical changes. There is hope in Russia.

ALEX ZENTRINKO
Magadan, Russia

I greatly enjoyed the article by Fen Montaigne. On a recent visit to Russia I cruised from St. Petersburg to Moscow. The resurgence of the Orthodox Church became very obvious at every stop we made. Churches, convents, monasteries, and cathedrals were being rebuilt, repaired, and refurbished. Amazingly, a great cathedral in Moscow [the Cathedral of Christ the Savior] was built in only three years. Young men are taking up the monastic life, and I even saw young soldiers

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PUBLIC TRANSPORTATION

Wherever life takes you

Earth's Grand Light Show

I once read a story by a man who felt his wife must be crazy because she claimed she could hear the aurora borealis. I had lived at both Yellowknife and Inuvik and simply felt that everyone could hear them. If an angel from heaven ever speaks to me, it will sound like that. Your article did not mention this, so I must be crazy.

SPURGEON G. ROSCOE
Halifax, Nova Scotia

You are not crazy. Check out the history of audible auroras at nationalgeographic.com/ngm/0111 and listen in at www-pw.physics.uiowa.edu/mcgreevy.

I would like to point out that I made the pictures on pages 50-51 (above). They were posted in the visitors center, where your photographer Norbert Rosing shot them. I run an aurora tour company, and these are pictures of my customers.

SEIJI SUZUKI
Yellowknife, Northwest Territories

attending religious services in the Cathedral of Peter and Paul in St. Petersburg.

IAN SMITH
Roslin, Scotland

Having worked for an international courier service, I've come to know the archaic and arbitrary customs regulations in Moscow. A few months ago Moscow's customs opened one of our document shipments and found a credit card, which was going to a lawyer. They refused to release the envelope to our local office unless we gave them confidential and personal information about the receiver. Our client of course was outraged. Even a large New York law firm was powerless against Russia's customs laws.

THOMAS SEGHINI
East Rockaway, New York

My wife is from St. Petersburg. Once while we were driving past the naval cruiser *Aurora*, which in 1917 fired the cannon shot signaling the beginning of the revolution, she told me that Russians often refer to it as history's most destructive warship. "One blank shot destroyed the entire nation," she simply explained. Let's hope it takes less than two and a half generations to accomplish the formidable task at hand for Russia now.

RICHARD A. BOULAIS
Glendale, Arizona

I lived in Moscow in 1993 when I was 18 and attended the first private university after the Soviet fall. I watched the beginning of the market economy take place. Corruption was rampant, but only because the people knew no other way. I attended school with the children of high-powered former communists and mobsters. Many of them were privileged under the old regime and knew how to make out in the new one. There are many evil people in Russia who prey on others, but most are warm and wonderful. Sometimes I long to return, but other times I remember it with great apprehension and think I'll never dare go back.

JESSICA LAMBORN
Salt Lake City, Utah

WRITE TO FORUM

National Geographic Magazine, PO Box 98199, Washington, DC 20090-8199, or by fax to **202-828-5460,** or via the Internet to **ngsforum@nationalgeographic.com.** Include name, address, and daytime telephone. Letters may be edited for clarity and space.

The Pyramid Builders

Thanks to Virginia Morell for passing along Zahi Hawass's belief that the Giza pyramids were built by Egyptian citizens, not slaves. I came across this idea when researching my masters degree 25 years ago, and since

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PUBLIC TRANSPORTATION

Wherever life takes you

then I have been explaining it to my students and co-workers. I'm glad today's excavations are correcting Herodotus and Hollywood.

TERRY SHARON
Flint, Michigan

ZipUSA: Steelville, MO

The article was designed to portray Steelvillians as a group of Neandertals who work and live here because we aren't smart enough to do anything else. We live here because we want to, not because we have to. We realize there are higher paying jobs in the cities, but we choose not to trade our privacy and security for endless traffic and crime-laden streets.

WARREN S. HENDRIX
Steelville, Missouri

As a longtime Missourian who has traveled the state photographing and writing about its people, I must tell you how disappointed I was in your coverage of Steelville. You must have found Steelville's evil twin from a parallel universe. Where were the fabulous float streams and the thousands of people who flock to enjoy them every weekend? Where were the national-class, live bluegrass shows? The wineries? The quaint resorts?

BOB McEOWEN
Jefferson City, Missouri

You said that the women work here because they are making the best of things. But a lot of women here work for the same reasons women anywhere do. They open shops and work with children because that is what they love. This comes from a 17-year-old girl who has lived a prosperous life because of this town.

KIYA HALBERT
Steelville, Missouri

You must have found Steelville's evil twin from a parallel universe. Where were the fabulous float streams and the thousands of people who flock to enjoy them every weekend? Where were the . . . live bluegrass shows? The wineries? The quaint resorts?

The author replies: I enjoyed my visit to Steelville and have fond memories of the people I met. When I described a young logger who was living exactly the life he wanted and a young veterinarian who wasn't, I was not being condescending. I was describing a place more connected to the land and less obsessed with money than many other parts of America.

Ask Us

Your picture of flamingos brought back memories of their stopovers on the mudflats of eastern Saudi Arabia. One day the flats would be black, the next they would be a beautiful pink from the flamingos standing shoulder to shoulder eating tidal shrimp. The more they ate, the pinker they became. Then a few weeks later they would be gone, leaving only a few pink feathers to remember them by.

ANTHONY BAUNE
Las Vegas, Nevada

Geographica

Your disturbing report on China's "farmed" bears provoked me to investigate the Animals Asia Foundation website. I have seen much abuse in my ten years as an animal rescuer in my community. But the horror of torture and suffering I saw on the Internet was beyond my imagination. Despite our intense discomfort, we must not turn away but instead focus on helping these precious and vulnerable animals by letter writing and donations to AAF. Twenty years to phase out 247 "bear farms" is unacceptable.

SUSAN BAEHMANN
Wilmington, North Carolina

Your article on Ossabaw Island gives the impression that it should be left untouched by humans. In fact, its striking vegetation and abundant animal life disguise its occupation by humans going back thousands of years. It was inhabited by advanced Native American groups up until the Spanish colonization. The oldest known fired ceramic pottery north of central Mexico has been found in this region. Ossabaw was the site of a Spanish mission, one of many in coastal Georgia and South Carolina. Rather than restrict the island to an academic elite or open it to a wave of Florida-like development, perhaps the best option would be to utilize volunteers to study and protect the ecology and artifacts. Now that would be an unusual vacation—working on the excavation of a 350-year-old Spanish mission or a 2,000-year-old village.

RICHARD THORNTON
Talking Rock, Georgia

Think you're too young for VIAGRA? Do you figure, "It only happens once in a while, so I'll just live with it"? Then nothing's going to change, especially your sex life.

See, erection difficulties, such as erectile dysfunction (ED), are a health condition. ED can be caused by many common factors, including smoking, stress, and high blood pressure. In fact, 1 out of 3 men of all ages have ED to some degree. Fortunately, VIAGRA can help men both get and keep an erection. Which is why **more than 9 million men** have turned to VIAGRA to treat their ED.

For more information, call 1-888-4VIAGRA or visit www.viagra.com. VIAGRA has already helped many love lives. How can it help yours?

VIAGRA
(sildenafil citrate) tablets

Join the millions. Ask your doctor if a free sample is right for you.

VIAGRA is indicated for the treatment of erectile dysfunction. Remember that no medicine is for everyone. If you use nitrate drugs, often used to control chest pain (also known as angina), don't take VIAGRA. This combination could cause your blood pressure to drop to an unsafe or life-threatening level.

Discuss your general health status with your doctor to ensure that you are healthy enough to engage in sexual activity. If you experience chest pain, nausea, or any other discomforts during sex or an erection that lasts longer than 4 hours, seek immediate medical help. The most common side effects of VIAGRA are headache, facial flushing, and upset stomach. Less commonly bluish vision, blurred vision, or sensitivity to light may briefly occur

Please see patient summary of information for VIAGRA (25-*mg*, 50-*mg*, 100-*mg*) *tablets on the following page.*

j o i n t h e m i l l i o n s.

PATIENT [illegible] OF [illegible] ABOUT

VIAGRA®
(sildenafil citrate) tablets

This summary contains important information about VIAGRA®. It is not meant to take the place of your doctor's instructions. Read this information carefully before you start taking VIAGRA. Ask your doctor or pharmacist if you do not understand any of this information or if you want to know more about VIAGRA.

This medicine can help many men when it is used as prescribed by their doctors. However, VIAGRA is not for everyone. It is intended for use only by men who have a condition called erectile dysfunction. **VIAGRA must never be used by men who are taking medicines that contain nitrates of any kind, at any time. This includes nitroglycerin. If you take VIAGRA with any nitrate medicine your blood pressure could suddenly drop to an unsafe or life threatening level.**

[illegible] Is VIAGRA?

VIAGRA is a pill used to treat erectile dysfunction (impotence) in men. It can help many men who have erectile dysfunction get and keep an erection when they become sexually excited (stimulated).

You will not get an erection just by taking this medicine. VIAGRA helps a man with erectile dysfunction get an erection only when he is sexually excited.

How Sex Affects the Body

When a man is sexually excited, the penis rapidly fills with more blood than usual. The penis then expands and hardens. This is called an erection. After the man is done having sex, this extra blood flows out of the penis back into the body. The erection goes away. If an erection lasts for a long time (more than 6 hours), it can permanently damage your penis. You should call a doctor immediately if you ever have a prolonged erection that lasts more than 4 hours.

Some conditions and medicines interfere with this natural erection process. The penis cannot fill with enough blood. The man cannot have an erection. This is called erectile dysfunction if it becomes a frequent problem.

During sex, your heart works harder. Therefore sexual activity may not be advisable for people who have heart problems. Before you start any treatment for erectile dysfunction, ask your doctor if your heart is healthy enough to handle the extra strain of having sex. If you have chest pains, dizziness or nausea during sex, stop having sex and immediately tell your doctor you have had this problem.

How VIAGRA Works

VIAGRA enables many men with erectile dysfunction to respond to sexual stimulation. When a man is sexually excited, VIAGRA helps the penis fill with enough blood to cause an erection. After sex is over, the erection goes away.

VIAGRA Is Not for Everyone

As noted above (*How Sex Affects the Body*), ask your doctor if your heart is healthy enough for sexual activity.

If you take any medicines that contain nitrates–either regularly or as needed–you should never take VIAGRA. If you take VIAGRA with any nitrate medicine or recreational drug containing nitrates, your blood pressure could suddenly drop to an unsafe level. You could get dizzy, faint, or even have a heart attack or stroke. Nitrates are found in many prescription medicines that are used to treat angina (chest pain due to heart disease) such as:

- nitroglycerin (sprays, ointments, skin patches or pastes, and tablets that are swallowed or dissolved in the mouth)
- isosorbide mononitrate and isosorbide dinitrate (tablets that are swallowed, chewed, or dissolved in the mouth)

Nitrates are also found in recreational drugs such as amyl nitrate or nitrite ("poppers"). If you are not sure if any of your medicines contain nitrates, or if you do not understand what nitrates are, ask your doctor or pharmacist.

VIAGRA is only for patients with erectile dysfunction. VIAGRA is not for newborns, children, or women. Do not let anyone else take your VIAGRA. VIAGRA must be used only under a doctor's supervision.

What VIAGRA Does Not Do

- VIAGRA does not cure erectile dysfunction. It is a treatment for erectile dysfunction.
- VIAGRA does not protect you or your partner from getting sexually transmitted diseases, including HIV–the virus that causes AIDS.
- VIAGRA is not a hormone or an aphrodisiac.

What To Tell Your Doctor Before You Begin [illegible]

Only your doctor can decide if VIAGRA is right for you. VIAGRA can cause mild, temporary lowering of your blood pressure. You will need to have a thorough medical exam to diagnose your erectile dysfunction and to find out if you can safely take VIAGRA alone or with your other medicines. Your doctor should determine if your heart is healthy enough to handle the extra strain of having sex.

Be sure to tell your doctor if you:

- have ever had any heart problems (e.g., angina, chest pain, heart failure, irregular heart beats, or heart attack)
- have ever had a stroke
- have low or high blood pressure
- have a rare inherited eye disease called retinitis pigmentosa
- have ever had any kidney problems
- have ever had any liver problems
- have ever had any blood problems, including sickle cell anemia or leukemia
- are allergic to sildenafil or any of the other ingredients of VIAGRA tablets
- have a deformed penis, Peyronie's disease, or ever had an erection that lasted more than 4 hours
- have stomach ulcers or any types of bleeding problems
- are taking any other medicines

[illegible] and Other Medicines

Some medicines can change the way VIAGRA works. Tell your doctor about **any medicines** you are taking. Do not start or stop taking any medicines before checking with your doctor or pharmacist. This includes prescription and nonprescription medicines or remedies. Remember, VIAGRA should never be used with medicines that contain nitrates (see *VIAGRA Is Not for Everyone*). If you are taking a protease inhibitor, your dose may be adjusted (please see *Finding the Right Dose for You.*) VIAGRA should not be used with any other medical treatments that cause erections. These treatments include pills, medicines that are injected or inserted into the penis, implants or vacuum pumps.

Finding the Right Dose for You

VIAGRA comes in different doses (25 mg, 50 mg and 100 mg). If you do not get the results you expect, talk with your doctor. You and your doctor can determine the dose that works best for you.

- Do not take more VIAGRA than your doctor prescribes.
- If you think you need a larger dose of VIAGRA, check with your doctor.
- VIAGRA should not be taken more than once a day.

If you are older than age 65, or have serious liver or kidney problems, your doctor may start you at the lowest dose (25 mg) of VIAGRA. If you are taking protease inhibitors, such as for the treatment of HIV, your doctor may recommend a 25 mg dose and may limit you to a maximum single dose of 25 mg of VIAGRA in a 48 hour period.

How To Take VIAGRA

Take VIAGRA about one hour before you plan to have sex. Beginning in about 30 minutes and for up to 4 hours, VIAGRA can help you get an erection if you are sexually excited. If you take VIAGRA after a high-fat meal (such as a cheeseburger and french fries), the medicine may take a little longer to start working. VIAGRA can help you get an erection when you are sexually excited. You will not get an erection just by taking the pill.

Possible Side Effects

Like all medicines, VIAGRA can cause some side effects. These effects are usually mild to moderate and usually don't last longer than a few hours. Some of these side effects are more likely to occur with higher doses. The most common side effects of VIAGRA are headache, flushing of the face, and upset stomach. Less common side effects that may occur are temporary changes in color vision (such as trouble telling the difference between blue and green objects or having a blue color tinge to them), eyes being more sensitive to light, or blurred vision.

In rare instances, men have reported an erection that lasts many hours. You should call a doctor immediately if you ever have an erection that lasts more than 4 hours. If not treated right away, permanent damage to your penis could occur (see *How Sex Affects the Body*).

Heart attack, stroke, irregular heart beats, and death have been reported rarely in men taking VIAGRA. Most, but not all, of these men had heart problems before taking this medicine. It is not possible to determine whether these events were directly related to VIAGRA.

VIAGRA may cause other side effects besides those listed on this sheet. If you want more information or develop any side effects or symptoms you are concerned about, call your doctor.

Accidental Overdose

In case of accidental overdose, call your doctor right away.

Storing VIAGRA

Keep VIAGRA out of the reach of children. Keep VIAGRA in its original container. Store at room temperature, 59°-86°F (15°-30°C).

For More Information on VIAGRA

VIAGRA is a prescription medicine used to treat erectile dysfunction. Only your doctor can decide if it is right for you. This sheet is only a summary. If you have any questions or want more information about VIAGRA, talk with your doctor or pharmacist, visit www.viagra.com, or call 1-888-4VIAGRA.

23-5515-00-4 June 1999

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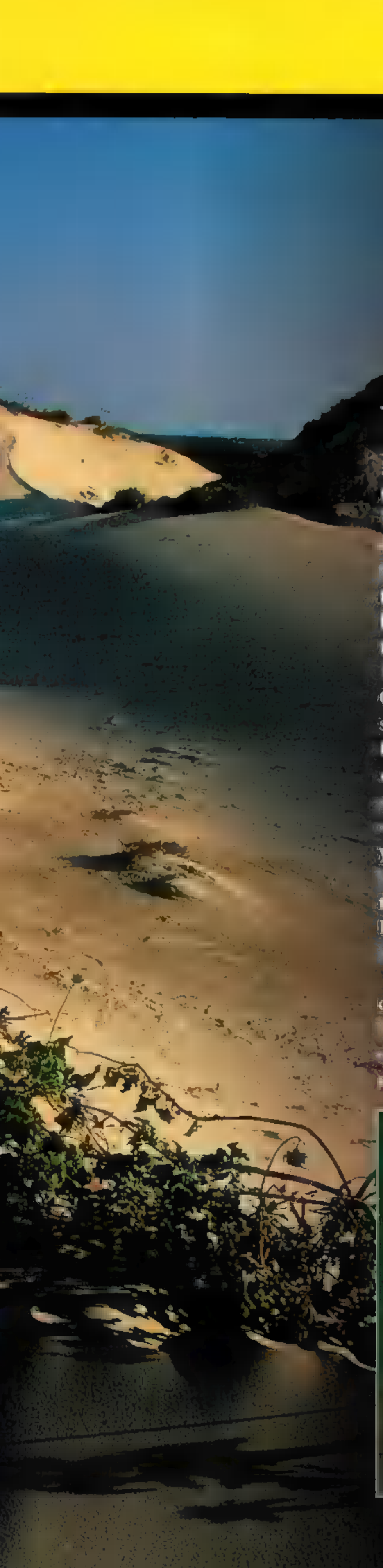
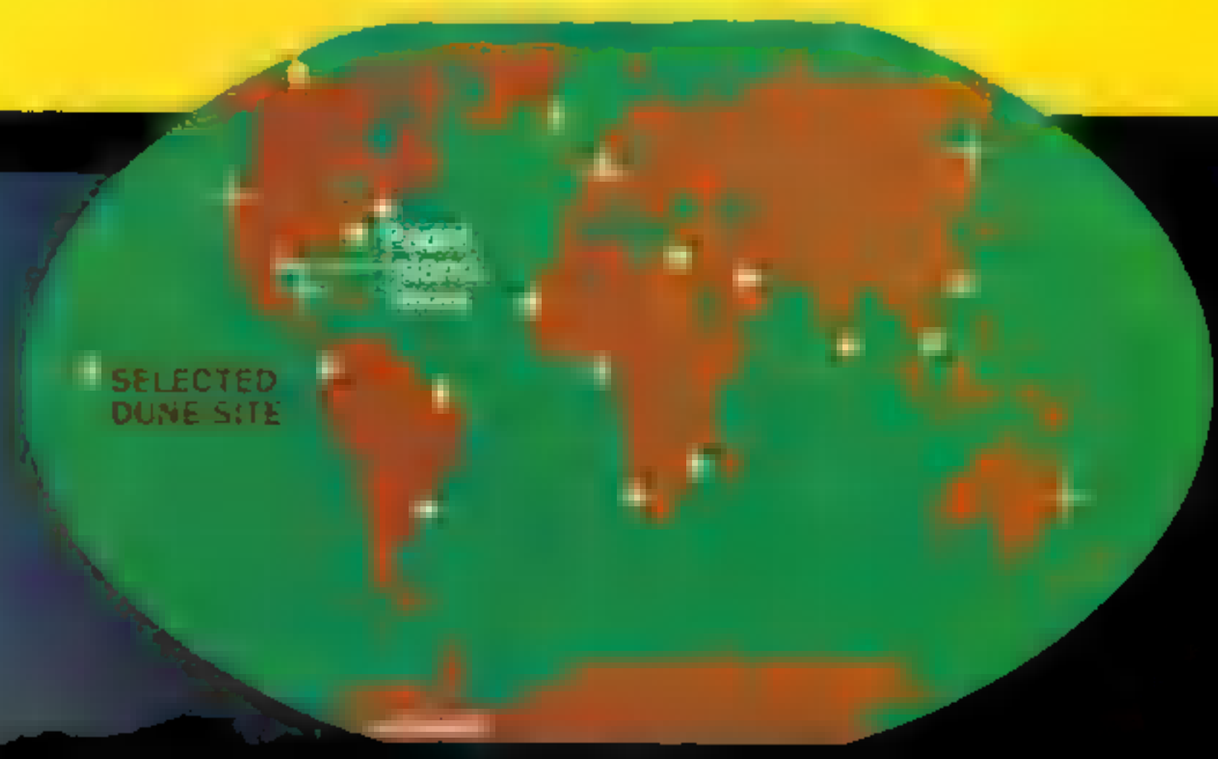




First line of defense against rising sea levels and storms, about 280 barrier islands ring the United States coast. The islands are sand dunes, poised to give way to the sea naturally—unless human distortions intervene. Dunes line shores on Padre Island and nearby Mustang Island [illegible] 370 miles along the Texas Gulf Coast. They help block storm surges headed inland toward Corpus Christi and other communities. Once covered with grass, Padre Island dunes were [illegible] by cattle until [illegible] years ago. New condominiums [illegible] on Mustang and the north and south ends of Padre Island, a threat that is [illegible].

In 1982 federal legislation created the Coastal Barrier [illegible], which now covers some 1,200 miles of shoreline. By the legislation does not prohibit development on barrier islands, it limits availability of federal flood insurance and other assistance.

On Texas beaches wildlife often needs help. The hawksbill sea turtle shown below was wrapped so tightly in fishing line that its left front flipper had to be amputated. It was treated and released by the University of Texas' Animal Rehabilitation Keep at Port Aransas on Mustang Island. Four other sea turtle species—the Kemp's ridleys, loggerheads, greens, and leatherbacks—may nest on the islands. All are endangered or threatened, so [illegible] found on the beaches are collected and incubated at protected sites; the hatchlings are later released.

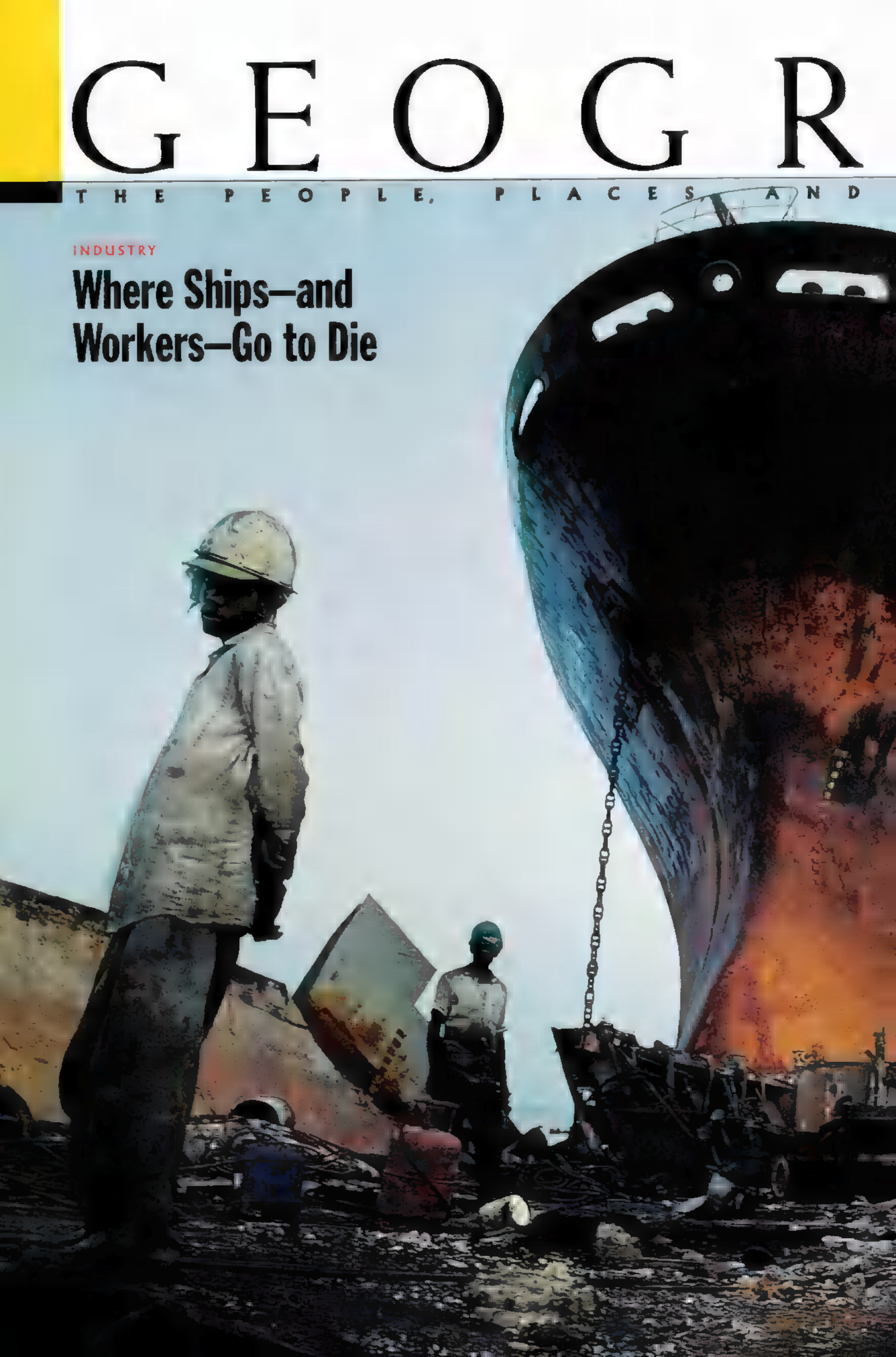
Find [illegible] and [illegible] our [illegible] at [illegible].com/ngm/resources/0203.

BOTH BY JAY DICKMAN

GEOGR
THE PEOPLE, PLACES AND

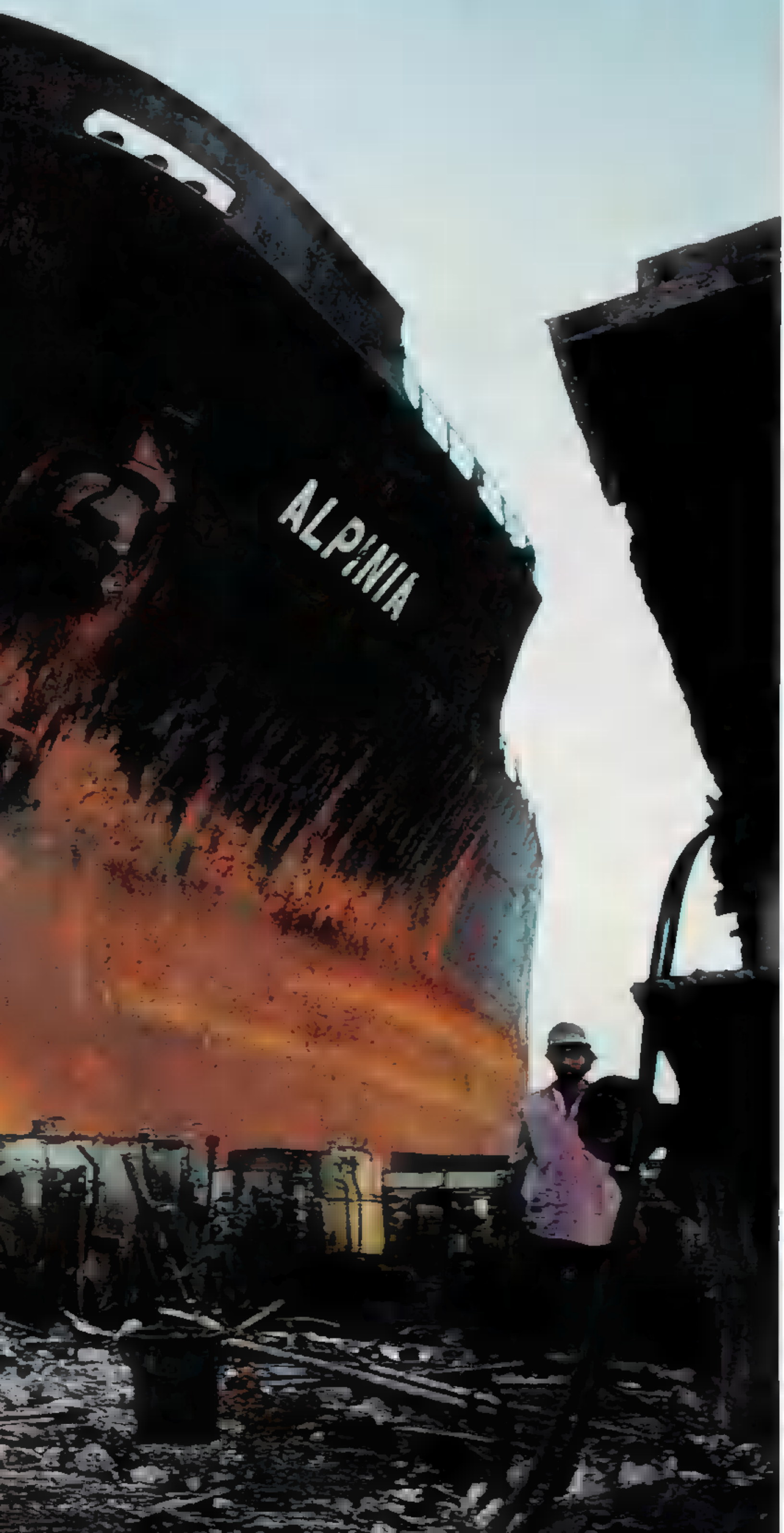
INDUSTRY

Where Ships—and Workers—Go to Die



APHICA

CREATURES OF OUR UNIVERSE



What happens to ships when they reach the end of their seaworthy lives after 20 or 30 years? Some 250 are sent to India annually. They wind up on a beach called Alang, the world's largest graveyard for oceangoing ships. Vessels like the freighter *Alpinia*, built in 1976, are simply run aground on the sand, where some of Alang's 30,000 workers begin cutting them up (below). The reclaimed steel makes up 7 percent of India's production.

Shipbreaking is dangerous. Hundreds of workers have died in accidents, including explosions, and many have been exposed to asbestos and other toxic agents. Now an Indian agency is working to improve safety equipment and procedures, such as those for removing toxics. And the UN is drawing up guidelines for safer scrapping of ships. Brian Parkinson of the International Chamber of Shipping urges that "environmental hazards be assessed before delivery of the ship to the recycling yard."

BOTH BY JASON EDWARDS, BIO-IMAGES

WILDLIFE

Canada's Blizzard of Birds

BOTH BY STEVE WINTER

A mecca for two million shorebirds, Canada's Bay of Fundy has 50-foot tides that heave tons of rich mud deposits ashore. Up to 95 percent of the world's semipalmated sandpipers, along with other species, stop over during summer to fuel up on such fare as mud shrimp. Many are banded and released (inset) in studies of bird migration. Come fall they fly to South America—a 1,900-mile nonstop trip.

"But this has become cottage country, and more and more people are walking the beaches and disturbing the birds," says Laurel Bernard of the Nature Conservancy of Canada. The Conservancy and several partners are raising funds to protect more than 9,000 acres in both New Brunswick and Nova Scotia.

WILLIAM WEST

COMMERCE

Sound Practices

Souvenir sales bring dollars to Australia's economy, but conservationists are worried that some of those sales may threaten the country's wild eucalyptus. Tourist demand for eucalyptus-wood didgeridoos (above), which Aborigines traditionally craft from tree limbs hollowed by termites, has driven production beyond limits allowed under government permits. A tagging system to help consumers identify legally made didgeridoos is in the works.

ALMANAC

March

From Florida to Texas, armadillos are now giving birth. Each normally bears identical quadruplets. The nine-banded armadillo, which originally ranged from South America to Mexico, moved into the U.S. around 1850. Similar to humans in their susceptibility to leprosy, armadillos are often used in medical studies.

BY JONATHAN LATIMER

Photographed by André Fatras

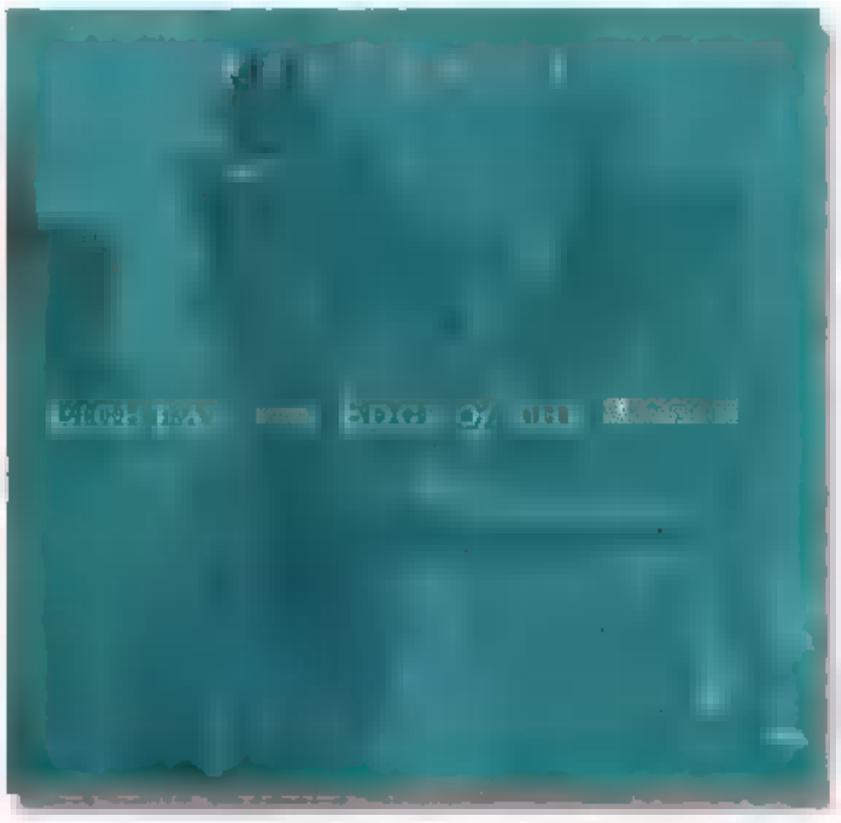
WILDLIFE AS CANON SEES IT

A fledgling wandering albatross catches a puff of wind, glides a few meters, then starts again. These practice take-offs prepare the young bird for its departure from the island and for the next seven to eleven years that it remains at sea. When the juvenile returns to its native island, it engages in elaborate courtship displays to establish a permanent pair-bond. Pairs devote a full year to the breeding cycle, in which a single chick is reared, then spend the next year back on the high seas. Mortality caused by longline fishing practices threatens the wandering albatross. Widespread adoption of measures to reduce bycatch is vital to its survival.

As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.

Wandering Albatross *(Diomedea exulans)*
Size: Length, 107-135 cm; wingspan, 254-351 cm
Weight: 6-11 kg
Habitat: Widely dispersed over the Southern Ocean; nests among tussock grass on hillocks, near ridges, and on flat grassy plains on remote oceanic islands
Surviving number: Estimated at 8,500 pairs

A remarkable new book from National Geographic Explorer-In-Residence and renowned anthropologist Wade Davis.



Light at the Edge of the World: A Journey Through the Realm of Vanishing Cultures takes you deep into diverse worlds that are fading away and reveals why preserving them all is of paramount importance.

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NATIONAL GEOGRAPHIC

A Career, By George!

Father of underwater archaeology still diving

BOTH BY COURTNEY PLATT

Our May 1962 issue pictured a young archaeology graduate student named George Bass and his wife, Ann, on their honeymoon, with artifacts recovered from a shipwreck off southern Turkey—the first full-scale excavation ever conducted by archaeologists on the seabed.

Forty years later the two are still at it (above), this time with items from a Greek Golden Age shipwreck that George describes in this issue. Underwater archaeology has thrived as an academic discipline since 1962, and George—founder of the Institute of Nautical Archaeology at Texas A&M—is known as its father. The Society has supported his work over the decades and honored him in 1988 with our Centennial Award.

The tools of his trade have changed. Now he dives to wrecks in a two-person submersible, which he used to observe archaeologist Elizabeth Greene with an amphora from the Greek ship (above). "For a while last year, using the submersible, we were finding a wreck a day off the Turkish coast, enough to keep archaeologists busy for the next 50 years," George marvels. His most satisfying project? He refuses to look back. "It's always the next one," he says.

Oceanic Tribute

In the North Pacific two undersea volcanoes bear the names of Ann Judge and Joe Ferguson, Society staffers killed when their hijacked plane hit the Pentagon September 11. The Board on Geographic Names ratified a proposal from Gail Cleere of the Office of Naval Research, who worked with Ann and Joe on an educational program.

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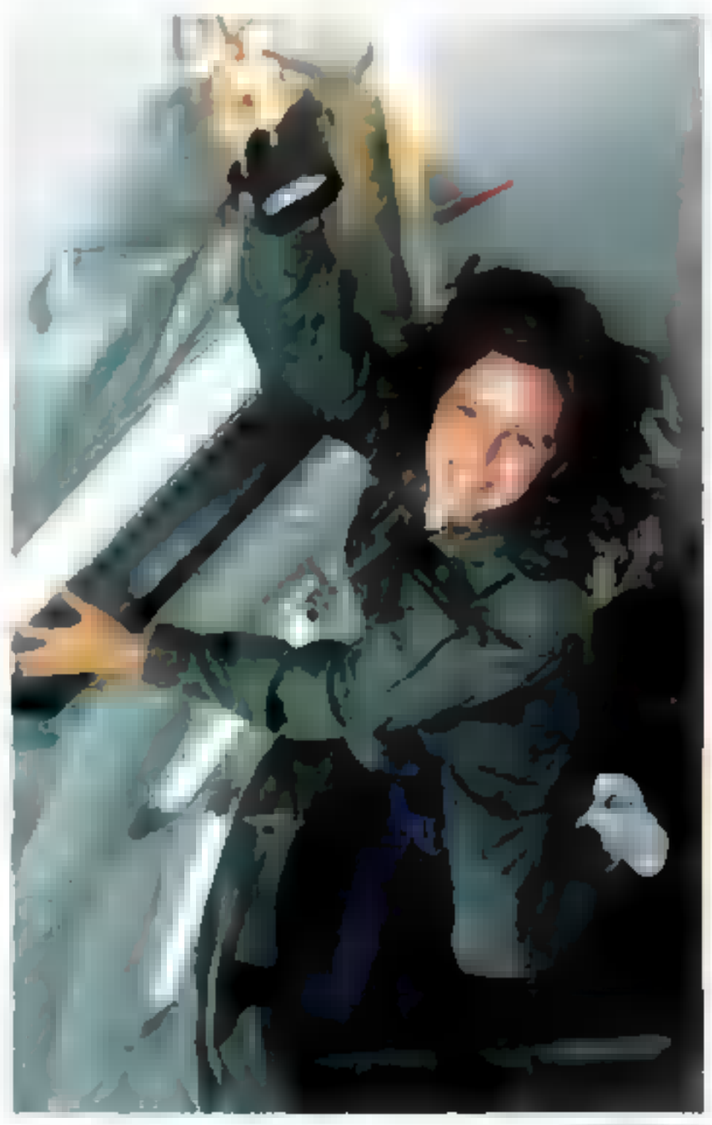
GSK makes an annual grant to the ACS for cancer research and education in return for the use of their seal.

CRAIG BUCK

Putting Sprawl in Plane View

Volunteer pilot helps photographer focus on conservation

Pilot Peter Coltman flies low as Joel Sartore photographs the urban sprawl in Texas that has destroyed the habitat of the Attwater's prairie-chicken (page 48). Peter offers his time and his renovated Beech 18 to LightHawk, ■ Wyoming-based nonprofit group whose 150 volunteer pilots fly photographers, writers, and citizens to shed light on environmental issues. "The best way to show the effect of sprawl on an ecosystem is from the air," says Joel, who flew three times with Peter in an effort to get the best image. "LightHawk helped out a ton. I didn't have to rent a helicopter or a plane for hours on end."



GSFC/NASA

In Zero G, Science Is a Laughing Matter

With the greatest of ease, staff writer Jennifer Steinberg (left) floats through the air in zero gravity on NASA's KC-135A aircraft out of Johnson Space Center. Jennifer accompanied a group of University of Wisconsin students chosen to design and test a remote-controlled robot in weightless conditions. The "Vomit Comet" took them on 25 parabolic ups and downs between double gravity and none at all. "At zero g everything went quiet—it was a Zen moment," Jennifer says. "I couldn't stop smiling. My jaw was sore by the end of the day."

FOR MORE INFORMATION

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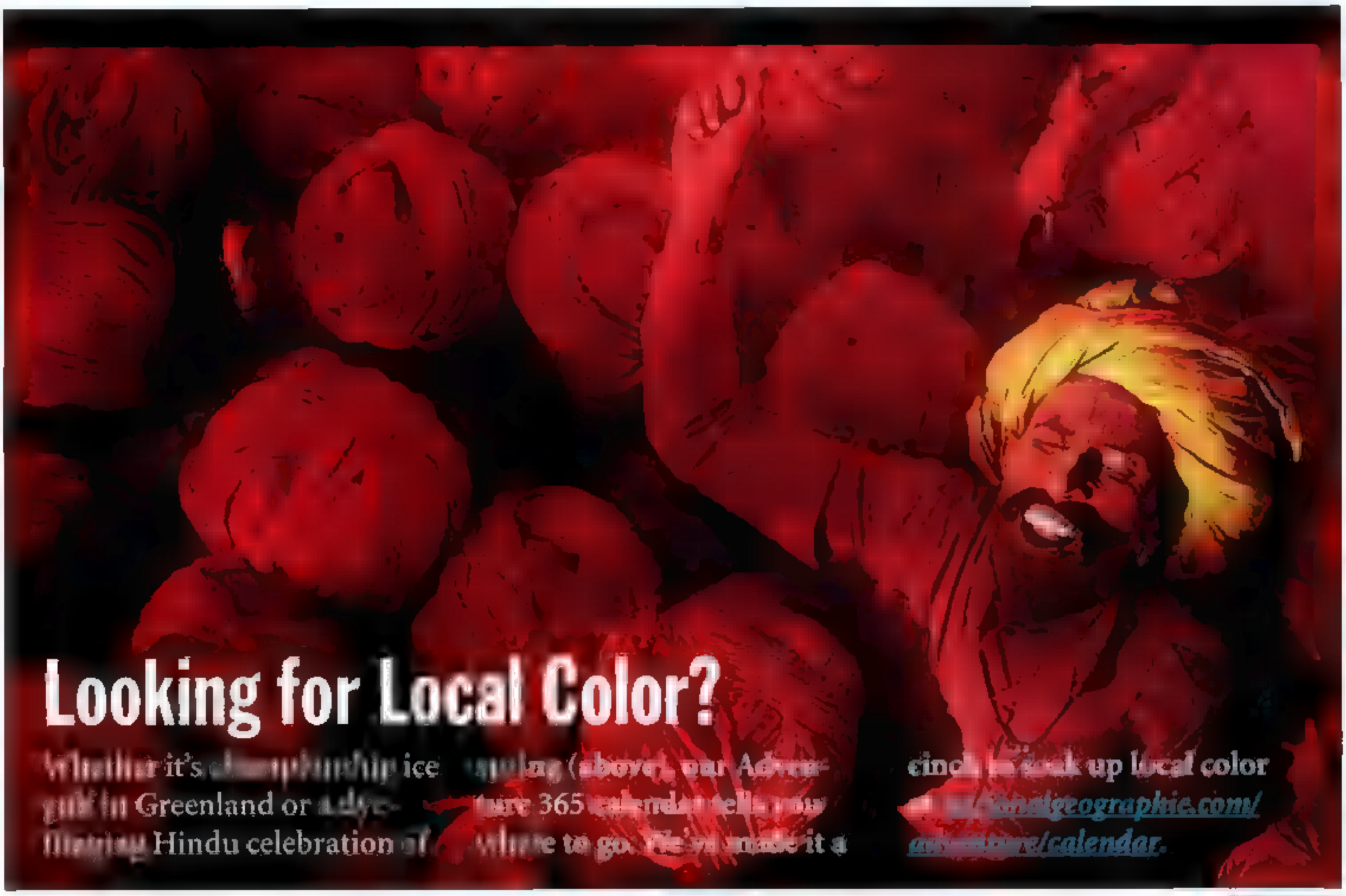

Looking for Local Color?

Whether it's championship ice golf in Greenland or a dye-flinging Hindu celebration of spring (above), our Adventure 365 calendar tells you where to go. We've made it a cinch to soak up local color at nationalgeographic.com/adventure/calendar.

STEVE McCURRY

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Diamonds

Symbols of love, wealth, and power, diamonds—like those adorning the scepter of Catherine the Great—have long held dark secrets. Some, furtively traded, today fuel terror and civil war. Photographer Cary Wolinsky narrates a journey from Angolan mines to street vendors in India to the shops of New York's master cutters. Experience the glitter and the grit of diamonds at nationalgeographic.com/ngm/0203.

GOKHRAN OF RUSSIA

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Peggy Fleming, Olympic Gold Medalist

Important information:

LIPITOR® (atorvastatin calcium) tablets is a prescription drug used with diet to lower cholesterol. LIPITOR is not for everyone, including those with liver disease or possible liver problems, women who are nursing, pregnant, or may become pregnant. LIPITOR has not been shown to prevent heart disease or heart attacks.

If you take LIPITOR, tell your doctor about any unusual muscle pain or weakness. This could be a sign of serious side effects. It is important to tell your doctor about any medications you are currently taking to avoid possible serious drug interactions. Your doctor may do simple blood tests to monitor liver function before and during drug treatment. The most commonly reported side effects are gas, constipation, stomach pain and indigestion. They are usually mild and tend to go away.

Please see additional important information on next page

PMO199/SI.OC36USC220606

Years of training helped figure skater Peggy Fleming bring home Olympic gold. And, while she can still land a double axel with ease, these days she needs a little help lowering her cholesterol. The good news is, if diet and exercise aren't enough, adding LIPITOR can lower your total cholesterol 29% to 45% and your bad cholesterol 39% to 60% (average effect depending on dose). It helped Peggy get some great scores. Maybe it can help you, too. One in five people has high cholesterol and millions need treatment — talk to your doctor to find out if LIPITOR is right for you. To learn more, contact us at **1-888-LIPITOR** or **www.lipitor.com.**

LIPITOR
atorvastatin calcium

FOR CHOLESSTEROL™

2002

LIPITOR® (Atorvastatin Calcium) Tablets
Brief Summary of Prescribing Information

CONTRAINDICATIONS: Active liver disease or unexplained persistent elevations of serum transaminases. Hypersensitivity to any component of this medication. **Pregnancy and Lactation** — Atherosclerosis is a chronic process and discontinuation of lipid-lowering drugs during pregnancy should have little impact on the outcome of long-term therapy of primary hypercholesterolemia. Cholesterol and other products of cholesterol biosynthesis are essential components for fetal development (including synthesis of steroids and cell membranes). Since HMG-CoA reductase inhibitors decrease cholesterol synthesis and possibly the synthesis of other biologically active substances derived from cholesterol, they may cause fetal harm when administered to pregnant women. Therefore, HMG-CoA reductase inhibitors are contraindicated during pregnancy and in nursing mothers. ATORVASTATIN SHOULD BE ADMINISTERED TO WOMEN OF CHILDBEARING AGE ONLY WHEN SUCH PATIENTS ARE HIGHLY UNLIKELY TO CONCEIVE AND HAVE BEEN INFORMED OF THE POTENTIAL HAZARDS. If the patient becomes pregnant while taking this drug, therapy should be discontinued and the patient apprised of the potential hazard to the fetus.

WARNINGS: Liver Dysfunction — HMG-CoA reductase inhibitors, like some other lipid-lowering therapies, have been associated with biochemical abnormalities of liver function. **Persistent elevations (>3 times the upper limit of normal [ULN] occurring on 2 or more occasions) in serum transaminases occurred in 0.7% of patients who received atorvastatin in clinical trials. The incidence of these abnormalities was 0.2%, 0.2%, 0.6%, and 2.3% for 10, 20, 40, and 80 mg, respectively.** One patient in clinical trials developed jaundice. Increases in liver function tests (LFT) in other patients were not associated with jaundice or other clinical signs or symptoms. Upon dose reduction, drug interruption, or discontinuation, transaminase levels returned to or near pretreatment levels without sequelae. Eighteen of 30 patients with persistent LFT elevations continued treatment with a reduced dose of atorvastatin. **It is recommended that liver function tests be performed prior to and at 12 weeks following both the initiation of therapy and any elevation of dose, and periodically (eg, semiannually) thereafter.** Liver enzyme changes generally occur in the first 3 months of treatment with atorvastatin. Patients who develop increased transaminase levels should be monitored until the abnormalities resolve. Should an increase in ALT or AST of >3 times ULN persist, reduction of dose or withdrawal of atorvastatin is recommended. Atorvastatin should be used with caution in patients who consume substantial quantities of alcohol and/or have a history of liver disease. Active liver disease or unexplained persistent transaminase elevations are contraindications to the use of atorvastatin (see CONTRAINDICATIONS). **Skeletal Muscle — Rhabdomyolysis with acute renal failure secondary to myoglobinuria has been reported with other drugs in this class.** Uncomplicated myalgia has been reported in atorvastatin-treated patients (see ADVERSE REACTIONS). Myopathy, defined as muscle aches or muscle weakness in conjunction with increases in creatine phosphokinase (CPK) values >10 times ULN, should be considered in any patient with diffuse myalgias, muscle tenderness or weakness, and/or marked elevation of CPK. Patients should be advised to report promptly unexplained muscle pain, tenderness or weakness, particularly if accompanied by malaise or fever. Atorvastatin therapy should be discontinued if markedly elevated CPK levels occur or myopathy is diagnosed or suspected. The risk of myopathy during treatment with other drugs in this class is increased with concurrent administration of cyclosporine, fibric acid derivatives, erythromycin, niacin, or azole antifungals. Physicians considering combined therapy with atorvastatin and fibric acid derivatives, erythromycin, immunosuppressive drugs, azole antifungals, or lipid-lowering doses of niacin should carefully weigh the potential benefits and risks and should carefully monitor patients for any signs or symptoms of muscle pain, tenderness, or weakness, particularly during the initial months of therapy and during any periods of upward dosage titration of either drug. Periodic creatine phosphokinase (CPK) determinations may be considered in such situations, but there is no assurance that such monitoring will prevent the occurrence of severe myopathy. **Atorvastatin therapy should be temporarily withheld or discontinued in any patient with an acute, serious condition suggestive of a myopathy or having a risk factor predisposing to the development of renal failure secondary to rhabdomyolysis (eg, severe acute infection, hypotension, major surgery, trauma, severe metabolic, endocrine and electrolyte disorders, and uncontrolled seizures).**

PRECAUTIONS: General — Before instituting therapy with atorvastatin, an attempt should be made to control hypercholesterolemia with appropriate diet, exercise, and weight reduction in obese patients, and to treat other underlying medical problems (see INDICATIONS AND USAGE in full prescribing information). **Information for Patients** — Patients should be advised to report promptly unexplained muscle pain, tenderness, or weakness, particularly if accompanied by malaise or fever. **Drug Interactions** — The risk of myopathy during treatment with other drugs of this class is increased with concurrent administration of cyclosporine, fibric acid derivatives, niacin (nicotinic acid), erythromycin, azole antifungals (see WARNINGS, Skeletal Muscle). ***Antacid:*** When atorvastatin and Maalox® TC suspension were coadministered, plasma concentrations of atorvastatin decreased approximately 35%. However, LDL-C reduction was not altered. ***Antipyrine:*** Because atorvastatin does not affect the pharmacokinetics of antipyrine, interactions with other drugs metabolized via the same cytochrome isozymes are not expected. ***Colestipol:*** Plasma concentrations of atorvastatin decreased approximately 25% when colestipol and atorvastatin were coadministered. However, LDL-C reduction was greater when atorvastatin and colestipol were coadministered than when either drug was given alone. ***Cimetidine:*** Atorvastatin plasma concentrations and LDL-C reduction were not altered by coadministration of cimetidine. ***Digoxin:*** When multiple doses of atorvastatin and digoxin were coadministered, steady-state plasma digoxin concentrations increased by approximately 20%. Patients taking digoxin should be monitored appropriately. ***Erythromycin:*** In healthy individuals, plasma concentrations of atorvastatin increased approximately 40% with coadministration of atorvastatin and erythromycin, a known inhibitor of cytochrome P450 3A4 (see WARNINGS, Skeletal Muscle). ***Oral Contraceptives:*** Coadministration of atorvastatin and an oral contraceptive increased AUC values for norethindrone and ethinyl estradiol by approximately 30% and 20%. These increases should be considered when selecting an oral contraceptive for a woman taking atorvastatin. ***Warfarin:*** Atorvastatin had no clinically significant effect on prothrombin time when administered to patients receiving chronic warfarin treatment. **Endocrine Function** — HMG-CoA reductase inhibitors interfere with cholesterol synthesis and theoretically might blunt adrenal and/or gonadal steroid production. Clinical studies have shown that atorvastatin does not reduce basal plasma cortisol concentration or impair adrenal reserve. The effects of HMG-CoA reductase inhibitors on male fertility have not been studied in adequate numbers of patients. The effects, if any, on the pituitary-gonadal axis in premenopausal women are unknown. Caution should be exercised if an HMG-CoA reductase inhibitor is administered concomitantly with drugs that may decrease the levels or activity of endogenous steroid hormones, such as ketoconazole, spironolactone, and cimetidine. **CNS Toxicity** — Brain hemorrhage was seen in a female dog treated for 3 months at 120 mg/kg/day. Brain hemorrhage and optic nerve vacuolation were seen in another female dog that was sacrificed in moribund condition after 11 weeks of escalating doses up to 280 mg/kg/day. The 120 mg/kg dose resulted in a systemic exposure approximately 16 times the human plasma area-under-the-curve (AUC, 0-24 hours) based on the maximum human dose of 80 mg/day. A single toxic convulsion was seen in each of 2 male dogs (one treated at 10 mg/kg/day and one at 120 mg/kg/day) in a 2-year study. No CNS lesions have been observed in mice after chronic treatment for up to 2 years at doses up to 400 mg/kg/day or in rats at doses up to 100 mg/kg/day. These doses were 6 to 11 times (mouse) and 8 to 16 times (rat) the human AUC (0-24) based on the maximum recommended human dose of 80 mg/day. CNS vascular lesions, characterized by perivascular hemorrhages, edema, and mononuclear cell infiltration of perivascular spaces, have been observed in dogs treated with other members of this class. A chemically similar drug in this class produced optic nerve degeneration (Wallerian degeneration of retinogeniculate fibers) in clinically normal dogs in a dose-dependent fashion at a dose that produced plasma drug levels about 30 times higher than the mean drug level in humans taking the highest recommended dose. **Carcinogenesis, Mutagenesis, Impairment of Fertility** — In a 2-year carcinogenicity study in rats at dose levels of 10, 30, and 100 mg/kg/day, 3 rare tumors were found in muscle in high-dose females: in one, there was a rhabdomyosarcoma and, in another, there was a fibrosarcoma. This dose represents a plasma AUC (0-24) value of approximately 16 times the mean human plasma drug exposure after an 80 mg oral dose. A 2-year carcinogenicity study in mice given 100, 200, or 400 mg/kg/day resulted in a significant increase in liver adenomas in high-dose males and liver carcinomas in high-dose females. These findings occurred at plasma AUC (0-24) values of approximately 6 times the mean human plasma drug exposure after an 80 mg oral dose. *In vitro*, atorvastatin was not mutagenic or clastogenic in the following tests with and without metabolic activation: the Ames test with *Salmonella typhimurium* and *Escherichia coli*, the HGPRT forward mutation assay in Chinese hamster lung cells, and the chromosomal aberration assay in Chinese hamster lung cells. Atorvastatin was negative in the *in vivo* mouse micronucleus test. Studies in rats performed at doses up to 175 mg/kg (15 times the human exposure) produced no changes in fertility. There was aplasia and aspermia in the epididymis of 2 of 10 rats treated with 100 mg/kg/day of atorvastatin for 3 months (16 times the human AUC at the 80 mg dose); testis weights were significantly lower at 30 and 100 mg/kg and epididymal weight was lower at 100 mg/kg. Male rats given 100 mg/kg/day for 11 weeks prior to mating had decreased sperm motility, spermatid head concentration, and increased abnormal sperm. Atorvastatin caused no adverse effects on semen parameters, or reproductive organ histopathology in dogs given doses of 10, 40, or 120 mg/kg for two years. **Pregnancy — Pregnancy Category X: See CONTRAINDICATIONS.** Safety in pregnant women has not been established. Atorvastatin crosses the rat placenta and reaches a level in fetal liver equivalent to that of maternal plasma. Atorvastatin was not teratogenic in rats at doses up to 300 mg/kg/day or in rabbits at doses up to 100 mg/kg/day. These doses resulted in multiples of about 30 times (rat) or 20 times (rabbit) the human exposure based on surface area (mg/m²). In a study in rats given 20, 100, or 225 mg/kg/day, from gestation day 7 through to lactation day 16 (weaning), there was decreased pup survival at birth, neonate, weaning, and maturity in pups of mothers dosed with 225 mg/kg/day. Body weight was decreased on days 4 and 21 in pups of mothers dosed at 100 mg/kg/day; pup body weight was decreased at birth and at days 4, 21, and 91 at 225 mg/kg/day. Pup development was delayed (rotorod performance at 100 mg/kg/day and acoustic startle at 225 mg/kg/day; pinnae detachment and eye opening at 225 mg/kg/day). These doses correspond to 6 times (100 mg/kg) and 22 times (225 mg/kg) the human AUC at 80 mg/day. Rare reports of congenital anomalies have been received following intrauterine exposure to HMG-CoA reductase inhibitors. There has been one report of severe congenital bony deformity, tracheo-esophageal fistula, and anal atresia (VATER association) in a baby born to a woman who took lovastatin with dextroamphetamine sulfate during the first trimester of pregnancy. LIPITOR should be administered to women of childbearing potential only when such patients are highly unlikely to conceive and have been informed of the potential hazards. If the woman becomes pregnant while taking LIPITOR, it should be discontinued and the patient advised again as to the potential hazards to the fetus. **Nursing Mothers** — Nursing rat pups had plasma and liver drug levels of 50% and 40%, respectively, of that in their mother's milk. Because of the potential for adverse reactions in nursing infants, women taking LIPITOR should not breast-feed (see CONTRAINDICATIONS). **Pediatric Use** — Treatment experience in a pediatric population is limited to doses of LIPITOR up to 80 mg/day for 1 year in 8 patients with homozygous FH. No clinical or biochemical abnormalities were reported in these patients. None of these patients was below 9 years of age. **Geriatric Use** — Treatment experience in adults age ≥70 years with doses of LIPITOR up to 80 mg/day has been evaluated in 221 patients. The safety and efficacy of LIPITOR in this population were similar to those of patients <70 years of age.

ADVERSE REACTIONS: LIPITOR is generally well-tolerated. Adverse reactions have usually been mild and transient. In controlled clinical studies of 2,502 patients, <2% of patients were discontinued due to adverse experiences attributable to atorvastatin. The most frequent adverse events thought to be related to atorvastatin were constipation, flatulence, dyspepsia, and abdominal pain. **Clinical Adverse Experiences** — Adverse experiences reported in ≥2% of patients in placebo-controlled clinical studies of atorvastatin, regardless of causality assessment, are shown in the following table:

Adverse Events in Placebo-Controlled Studies (% of Patients)

BODY SYSTEM Adverse Event	Placebo N = 270	Atorvastatin 10 mg N = 863	Atorvastatin 20 mg N = 36	Atorvastatin 40 mg N = 79	Atorvastatin 80 mg N = 94
BODY AS A WHOLE					
Infection	10.0	10.3	2.8	10.1	7.4
Headache	7.0	5.4	16.7	2.5	6.4
Accidental Injury	3.7	4.2	0.0	1.3	3.2
Flu Syndrome	1.9	2.2	0.0	2.5	3.2
Abdominal Pain	0.7	2.8	0.0	[illegible]	2.1
Back Pain	3.0	2.8	0.0	3.8	1.1
Allergic Reaction	2.6	0.9	2.8	1.3	0.0
Asthenia	1.9	[illegible]	0.0	3.8	0.0
DIGESTIVE SYSTEM					
Constipation	1.8	2.1	0.0	2.5	1.1
Diarrhea	1.5	2.7	0.0	3.8	5.3
Dyspepsia	4.1	2.3	2.8	1.3	2.1
Flatulence	3.3	2.1	2.8	1.3	1.1
RESPIRATORY SYSTEM					
Sinusitis	2.6	2.8	0.0	2.5	5.4
Pharyngitis	1.5	2.5	0.0	1.3	2.1
SKIN AND APPENDAGES					
Rash	0.7	3.9	2.8	3.8	1.1
MUSCULOSKELETAL SYSTEM					
Arthralgia	1.5	2.0	0.0	5.1	[illegible]
Myalgia	1.1	3.2	5.6	1.3	0.0

The following adverse events were reported, regardless of causality assessment in patients treated with atorvastatin in clinical trials. The events in italics occurred in ≥2% of patients and the events in plain type occurred in <2% of patients:

Body as a Whole: Chest pain, face edema, fever, neck rigidity, malaise, photosensitivity reaction, generalized edema. ***Digestive System:*** Nausea, gastroenteritis, liver function tests abnormal, colitis, vomiting, gastritis, dry mouth, rectal hemorrhage, esophagitis, eructation, glossitis, mouth ulceration, [illegible] appetite, stomatitis, biliary pain, cheilitis, duodenal ulcer, dysphagia, enteritis, melena, gum hemorrhage, stomach ulcer, tenesmus, ulcerative [illegible] hepatitis, pancreatitis, cholestatic jaundice. ***Respiratory System:*** Bronchitis, rhinitis, pneumonia, dyspnea, asthma, epistaxis. ***Nervous System:*** Insomnia, dizziness, paresthesia, somnolence, amnesia, abnormal dreams, libido decreased, emotional lability, incoordination, peripheral neuropathy, torticollis, facial paralysis, hyperkinesia, depression, hypesthesia, hypertonia. ***Musculoskeletal System:*** Arthritis, leg cramps, bursitis, tenosynovitis, myasthenia, tendinous contracture, [illegible]. ***Skin and Appendages:*** Pruritus, contact dermatitis, alopecia, dry skin, sweating, acne, urticaria, eczema, seborrhea, skin ulcer. ***Urogenital System:*** Urinary tract infection, urinary frequency, cystitis, hematuria, impotence, dysuria, kidney calculus, nocturia, epididymitis, fibrocystic breast, vaginal hemorrhage, albuminuria, breast enlargement, metrorrhagia, nephritis, urinary incontinence, urinary retention, urinary urgency, [illegible] ejaculation, uterine hemorrhage. ***Special Senses:*** Amblyopia, tinnitus, dry eyes, retraction disorder, eye hemorrhage, deafness, glaucoma, parosmia, taste loss, taste perversion. ***Cardiovascular System:*** Palpitation, vasodilatation, syncope, migraine, postural hypotension, phlebitis, arrhythmia, angina pectoris, hypertension. ***Metabolic and Nutritional Disorders:*** Peripheral edema, hyperglycemia, creatine phosphokinase increased, gout, weight gain, hypoglycemia. ***Hemic and Lymphatic System:*** Ecchymosis, anemia, lymphadenopathy, thrombocytopenia, petechia. ***Postintroduction Reports*** — Adverse events associated with LIPITOR therapy reported since market introduction, that are not listed above, regardless of causality assessment, include the following: anaphylaxis, angioneurotic edema, bullous rashes (including erythema multiforme, Stevens-Johnson syndrome, and toxic epidermal necrolysis), and rhabdomyolysis.

OVERDOSAGE: There is no specific treatment for atorvastatin overdosage. In the event of an overdose, the patient should be treated symptomatically, and supportive measures instituted as required. Due to extensive drug binding to plasma proteins, hemodialysis is not expected to significantly enhance atorvastatin clearance.

This summary provides important information about Lipitor. For more information, please ask your doctor, pharmacist or healthcare professional to provide the professional labeling and then discuss it with them.

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National Geographic TV

NATIONAL GEOGRAPHIC EXPLORER, [illegible]

Violent Rites

The discovery of a mass grave on the north coast of Peru, home of the Moche civilization from A.D. 200 to 800, raises questions about how an ancient people practiced human sacrifice. An EXPLORER film examines this mystery by following forensic anthropologist John Verano as he deciphers the story behind the skeletons at the Pyramid of the Moon. Did the Moche take prisoners and then massacre them as sacrifices to the gods? Or were the sacrificed victims the losers of ritual combat (reenacted at left) between Moche nobility? The film moves between the grave and the forensic lab in its search for answers.

[illegible] EVANS, NGT

NATIONAL GEOGRAPHIC CHANNEL

Snakes Alive

Handy with snakes of all sizes and temperaments, herpetologist Rom Whitaker (right) can afford to relax with a bull snake, a nonvenomous constrictor found in North America. But his skills receive a workout in India as he sets out to capture the world's largest venomous snake in *King Cobra*. Allergic to antivenom, Whitaker knows that the next bite could kill him. *King Cobra* sets a gripping tone for a weeklong event called *5 Days of Snakes*—a film festival on the reptiles that fascinate and repel us.

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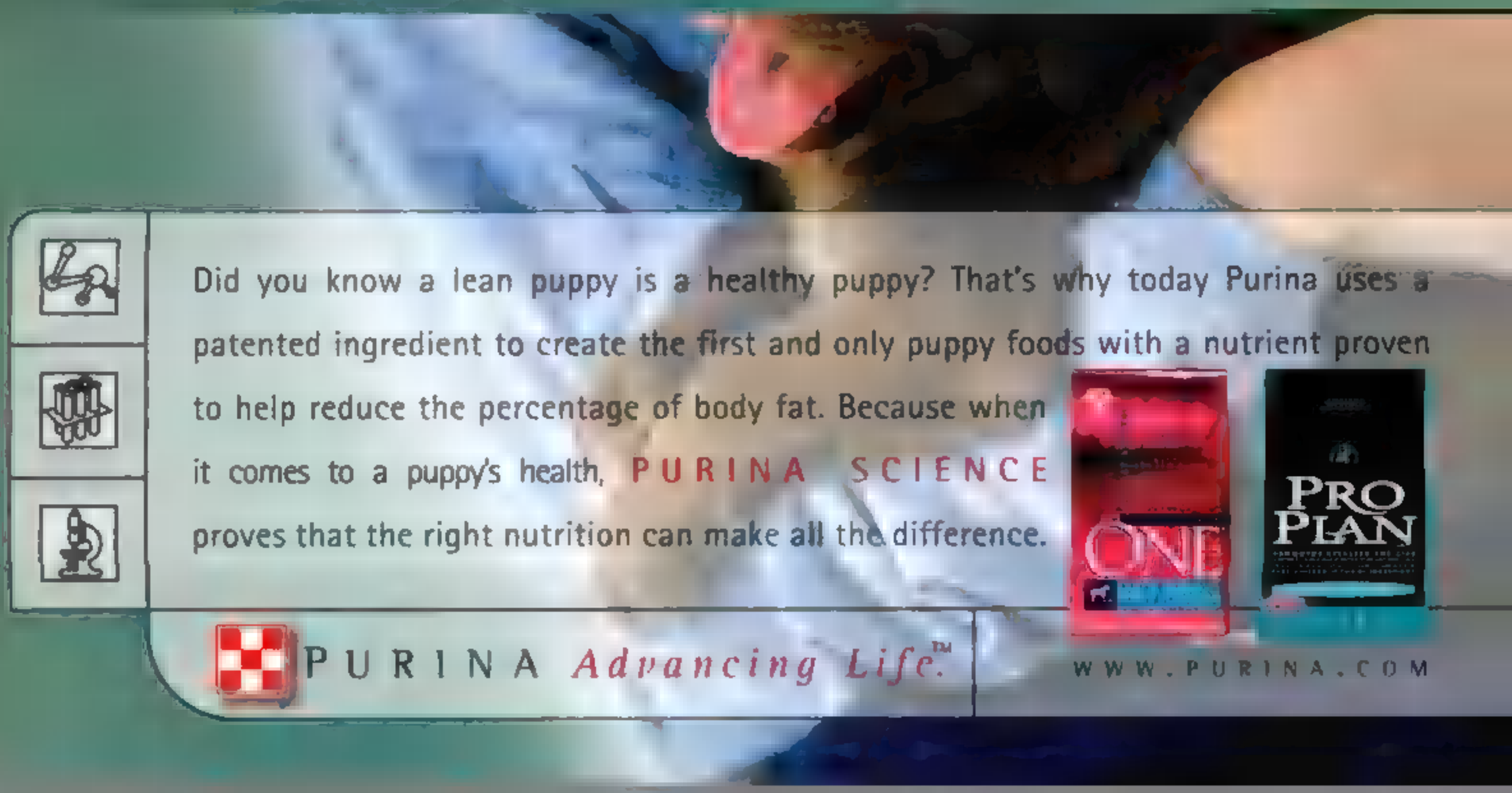

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Ask Us

THE ANSWER PLACE

Our Research Correspondence staff responds to questions from curious readers.

Q What is the most common town name in the U.S.?

A "Fairview" is the most common name for a populated place, according to the U.S. Board on Geographic Names. "Midway" is next, followed by "Oak Grove."

Q When I see a double rainbow, the colors in the second one are reversed. Why is that?

A When sunlight strikes a raindrop, light rays go in, bounce off the back of the drop, and come back out. When passing in and out, the rays bend—as in a prism—and the colors are separated so that we see the hues of the rainbow, with red on the outer arc. A smaller number of rays reflect twice inside the drop before they exit. The second reflection inverts the image, resulting in a paler secondary rainbow with red on the inner arc. Sometimes a third bow, with red again on the outer rim, is visible.

Q If the moon rotates on its axis, then why do we always see the same side of it?

A The short answer is that the moon is a bit lopsided. Earth's gravitational force on the moon is much stronger than the moon's tide-producing pull on Earth. Over eons Earth's gravity caused the moon's center of mass to bulge, so that the moon became slightly egg shaped, with one side heavier than the other. Earth pulled more strongly on the heavier side, and gradually the moon's rotation slowed so that it spins once each time it orbits the Earth. The moon's heavy-side face is the one we always see.

MORE INFORMATION

Send questions to **Ask Us, National Geographic Magazine, PO Box 96095, Washington, DC 20090-6095** or via the Internet to **ngsaskus@nationalgeographic.com.** Include name, address, and daytime phone number.

TELL US

How [illegible] do clouds like these [illegible]? Hint: Fluffy appearances can be deceiving.

Think you know the answer? Go online to nationalgeographic.com/ngm/tellus/0203 and test yourself, or read it here in next month's issue.

February answer: [illegible] with water in pavement [illegible] near the [illegible] paper [illegible] and any [illegible]

[illegible] EASTCOTT AND [illegible] MOMATIUK

Diamo

The Real Story

Discovery of this rare diamond in the Democratic Republic of the Congo sparked high-level intrigue. Then the stone vanished, only to resurface in New York City. Tracking this gem revealed the world of diamonds—a labyrinth linking multimillion-dollar mines, bloody wars, and timeless beauty.

nds

In the Rough

Dark lines drawn on the crystal show where the first cuts will be made in this 265.82-carat stone. It was eventually crafted into four stable diamonds whose total value remains a secret.

DAVID LIPMAN AND JOHAN

Work of Art

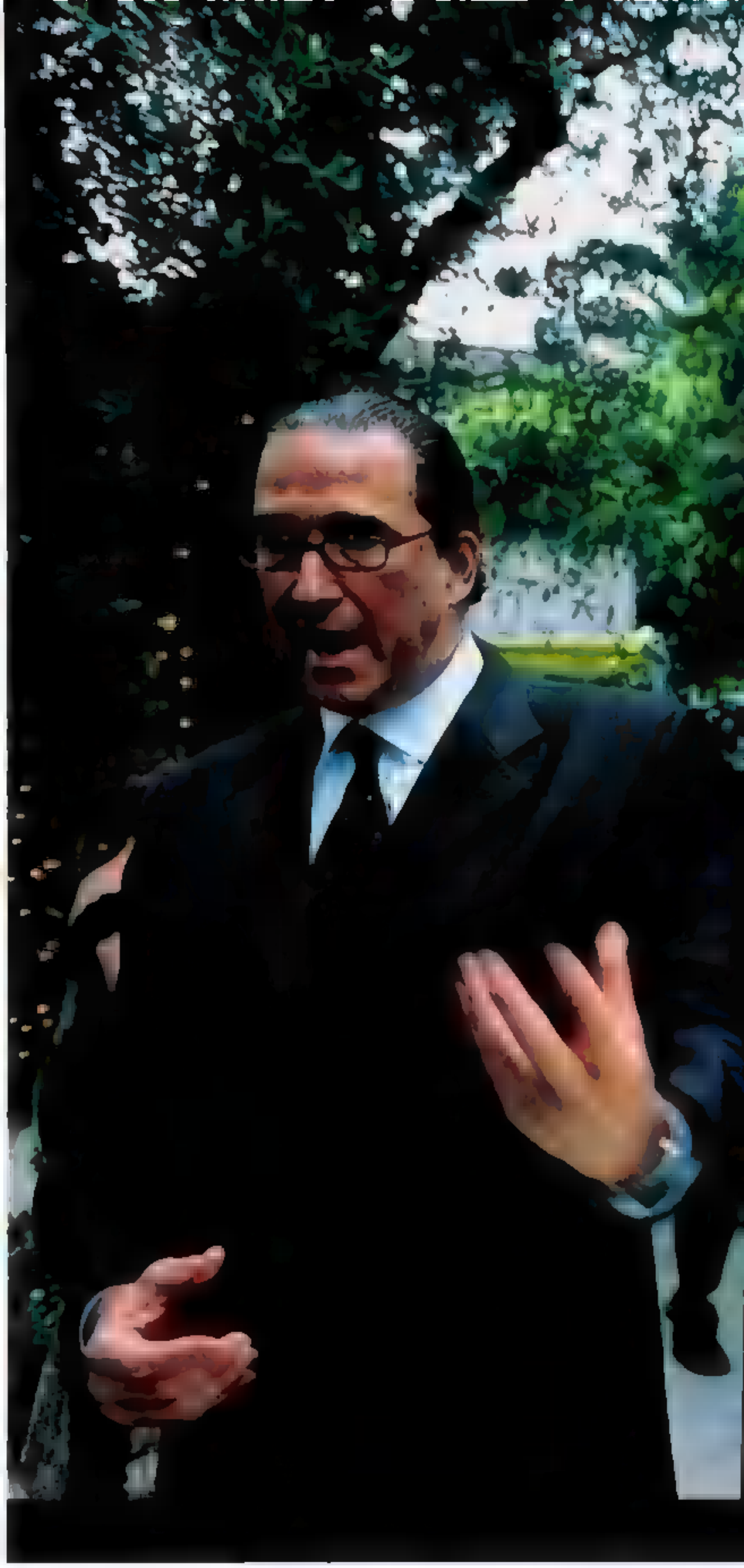
Flanked by colleagues, New York master cutter Motti Bernstein displays the grandest of the stones cut from the Cullinan giant. At 232.23 carats, it's the largest flawless pear-cut diamond in history. Its worth? "When I cut a diamond," says Bernstein, "I don't think about value; otherwise I get nervous."

By Andrew Cockburn
Photographs by Cary Wolinsky

In a little house down a muddy lane in Saurimo, a remote city in northeastern Angola, Tony Cabengele unfolded a sheet of white paper and rolled a small, squarish, cloudy white stone onto the table. "Let me teach you about diamonds," he said earnestly, unwrapping more stones and piling them into a little pyramid. "They are full of surprises."

A French-speaking native of the neighboring Democratic Republic of the Congo, Cabengele had moved here to try his luck as a trader in the rich Angolan diamond fields. There are safer places to do business. Saurimo, the capital of Angola's Lunda Sul Province, is in the midst of a hotly contested area in the civil war between the Angolan government and the UNITA rebels, now degenerated into savagery on all sides. The night before my visit with Cabengele drunken soldiers had celebrated Angola's independence day with heavy gunfire and grenade explosions around town. When I arrived at his house, he was swathed in bloody bandages, albeit merely because Mrs. Cabengele had taken umbrage at his late return from the festivities and smashed a glass lamp over his head.

Presented with an interested listener, the affable 32-year-old appeared to forget his injuries. Dispatching a boy for beer and sodas, he placed a small digital scale, a clear glass plate, and a sheet of white paper on the table beside his pyramid of stones. "I know this is crystal because it is octahedral," he explained, holding up a little diamond in a pair of tweezers. He set it on the plate, which he held over a bright light. "This helps you judge the clarity," he said, examining the stone for impurities. He selected another diamond to demonstrate how the white paper helped him judge color.



"This is what we call *glace* [ice]," he said. The color of the stone almost matched the paper. He picked up a larger lump, dirty gray. "This is *makbar,* 30 carats but of inferior quality—not worth much."

Despite their differences, these little pebbles shared the unique characteristics of all diamonds: so hard that they can be scratched only with another diamond, so dense that they slow the speed of light by almost two-thirds, cold to the touch, because they draw heat from your fingers.

They were ancient. Created from carbon under titanic pressure and enormous heat deep

Love for Sale

Flesh and stones are artfully packaged at a fete on the French Riviera, where diamond merchant Saul Goldberg touts a 3.5-million-dollar necklace on a live model. One of the 22-carat stones at her throat came from the huge Congolese rough, acquired and cut by Goldberg's firm.

underground when the Earth was young, the diamonds I held in my hand had remained just below the deepest layers of the Earth's crust until, perhaps a hundred million years ago, they rode up to the surface in a fast-moving eruption of molten rock called kimberlite. The kimberlite cooled in narrow funnels shaped like carrots, with their wide, rounded ends sticking up from the surface. Millions of years of rain and weather inexorably eroded the surface portion of the kimberlite pipes until the freed diamonds washed across the landscape and finally lodged in the gravel of a riverbed or the soft red Lunda Sul soil *(Continued on page 12)*

Africa

Photographs by Tim Hetherington

On a continent ravaged by civil strife, "conflict" diamonds have financed the desperate efforts of rebel warlords. The price paid by terrorized Africans has shocked the world and tarnished the luster of an industry.

These children at a shelter in Freetown, Sierra Leone, pay a fierce price for the inhuman suffering caused by "conflict" or "blood" diamonds. They have lost arms or legs—victims of the Revolutionary United Front, a vicious rebel army that terrorized civilians into submission by systematically hacking off limbs. Rebel control of rich diamond fields financed the civil war in Sierra Leone with sales to an unquenchable international market. Thanks to photographs such as these, conflict diamonds became a global scandal, threatening the romantic image nurtured by the diamond industry. "Perhaps what is happening in Sierra Leone is our problem," announced one horrified industry insider after visiting a camp for amputees. "Perhaps it is our business." The business of mining here is bound even without rebel atrocities. Clenching an air hose in his teeth, one miner prepares to dive to the bottom of a muddy pond to gather gravel (right). For years such laborers have been little more than slaves.

Frantic Harvest

In a small village in Sierra Leone, a stick-wielding miner defends his team's precious gravel from desperate rivals. Teams of miners take 30-minute turns to pump up gravel, which may contain diamonds. But average pickings are meager—barely enough to pay for food. Most workers live on the illusion that one day a big stone will free them from misery.

(Continued from page 7) to await the day when lucky diggers prized them out and brought them here to this room for sale. I picked up a half dozen and rubbed them with my thumb. They had a smooth, soapy texture.

A question formed as I fingered the rough diamonds. Even in their present state they were valuable enough to incite avarice and bloodshed. Transformed from rough to gem, they would come to symbolize romance, strength, beauty, wealth. Why do diamonds, more than any other substance on Earth, capture imagination and ignite passion?

I heard many explanations—from mystical to cynical—as I followed diamonds around the world. None of them answered the question fully, although the woman who told me why she had just stood in line for two hours in a chill Parisian drizzle to see an exhibition of diamonds—"It's the closest you'll ever come to a star"—did as well as any.

This is not to say that the natural allure of diamonds is not actively nurtured by those who profit from them. When a gang of thieves with a stolen bulldozer plowed into London's Millennium Dome in November 2000 to steal a 203-carat diamond from a display sponsored by De Beers, Nicky Oppenheimer, De Beers's chairman, hailed the botched heist as wonderful publicity. "If only we could do this once every six months. We could do away with the advertising department altogether."

Beyond De Beers, the South African colossus that dominates the business, stretches an intricate and close-knit worldwide diamond network that operates in some respects on a vast industrial scale and in others like a medieval guild. The torrent of stones that circulates through the network moves along a path referred to as "the pipeline" from mines to dealers to polishing factories to jewelers to the necks and fingers of customers—a journey that takes somewhere between one and two years. There are many inlets to this pipeline: vast open pits in the Arctic Circle and the Kalahari Desert, deep underground tunnels, even floating mines out in the South Atlantic.

Tony Cabengele was deep into our tutorial when we were interrupted by the arrival of three men in jeans and T-shirts muttering polite greetings in Portuguese. They were *garimpeiros*, as diggers are called in Angola. One of them carefully unwrapped a paper packet and produced a stone the size of a chickpea. The scale recorded it as weighing 3.49 carats (a carat is one-fifth of a gram). I was impressed, Cabengele less so. "It's a double-decker," he said. With the three men watching his every move intently, he handed me his loupe, the little ten-power magnifying glass that is the standard tool of the trade. "See, it's two stones fused together, and they are of different qualities."

It was time for the bargaining to begin. Picking up a small calculator, Cabengele tapped out an offer, $750, and handed the calculator to the diggers. They passed back their price, $2,200. The calculator flew to and fro across the table. The sellers eventually retreated to $1,600; Cabengele went up to $900. Apart from the staccato rattle of the calculator keys, the entire exercise was conducted in silence. The trio eventually indicated that there was to be no sale by rising to their feet and shaking hands all around. "They won't get a better price anywhere else," said Cabengele laconically after the diggers had departed with their stone. He unerringly re-sorted his own diamonds and wrapped them back up into their paper containers. "With diamonds," he mused, "you can be poor today and a millionaire tomorrow—and maybe poor again the day after."

A few weeks later, in the control room of the diamond mining ship *Debmar Pacific*, 18 miles off the desert coast of Namibia, Randall Baker, a marine production supervisor, peered at a monitor to check on the progress of the 17-foot-wide drill bit that probed the floor of the South Atlantic 300 feet below us. Out on deck the deafening roar of the ship's machinery, sucking up 90 metric tons of ocean floor an hour, continued day and night, seven days a week.

Around us, on the gently heaving sea, were four more of the fleet of floating mines operated by a subsidiary of De Beers. Based on statistical calculations of the number of diamonds washed across southern Africa and out to sea by the Orange River over the past hundred million years, the head office had assigned our ship a precise target of 19,000 carats for the month, which averaged out at just over 26 carats an hour. Most would be of gem quality, around one carat. "If we don't meet the target, we'll start getting calls from the head office asking if we're throwing diamonds over the side," said the ship's captain, John Gray, formerly of the Royal Navy.

Gray and Baker were less emotive than Cabengele had been about the treasure they were hunting, perhaps because they never actually see a diamond. The elusive stones brought up in all that rock and debris are winnowed out in a series of sieves, centrifuges, and x-ray machines locked away from human intervention before they're sealed in plain metal cans and flown to the mainland.

"Last week I was working on top of the ship repairing a radio aerial," mused Baker in his thick Cape Town accent. "I looked down at the whole operation and at the other ships, and I thought, All these millions of dollars' worth of technology, all these people working, for a completely nonessential item."

"Thank god for women," remarked Gray, helping himself to a cup of coffee.

Diamonds may be a girl's best friend, but part of the enticement can be explained by simple arithmetic. The 120 million carats of rough diamonds extracted globally from the Earth every year weigh a total of just 24 tons, a single truckload, but those 24 tons are sold by the producers for about seven billion dollars. Since they cost less than two billion dollars to extract, the profits are already immense. By the time the diamonds reach the customers waiting at the far end of the pipeline, the truckload, set in jewelry, is worth over 50 billion dollars.

MAHWI BENJAMIN and I bounced in his truck along a track lined with pale green rock. Mahwi, the mineral resources manager, was escorting me to the bottom of the pit at Jwaneng, out on the fringes of Botswana's Kalahari Desert. This mine might well be the most valuable piece of productive real estate on Earth. De Beers prospectors discovered a pipe of kimberlite here in 1973, thanks to helpful termites that, over millennia, had toted garnets and ilmenites, minerals associated with diamond deposits, up through 120 feet of rock and sand. Now, at a running cost of some 90 million dollars annually, the mine yields over a billion dollars' worth of diamonds a year. The fountain of money pouring out of Jwaneng and two other De Beers-controlled mines now gives Botswana, which had almost no resources when the first kimberlite pipe was discovered there in 1967, one of the highest standards of living in Africa.

Standing on the floor of the pit, its terraced sides soaring a thousand feet above me, I leaned over to tie my shoelace. "Don't touch the ground," Mahwi said sharply. "It's forbidden." He admitted that the odds against my actually spotting a diamond amid the sea of rock were five million to one. Nevertheless, here, as at all other De Beers operations, there is a perpetual struggle against temptation, with progressively more restricted color-coded security zones, remote cameras, and stringent searches, not to mention a fenced zone surrounding the whole complex. "The simple fact of human nature," explained Steve Gould, the Jwaneng mine manager, "is that if people can get hold of diamonds, they will keep them."

Critics insist that the high price of diamonds is purely artificial, not subject to economic constraints of supply and demand but entirely dependent on the machinations of De Beers—a cartel, as it is often called, not least by the antitrust division of the United States Department of Justice. (De Beers was indicted in a 1994 price-fixing case, and its executives do not set foot on U.S. soil for fear of subpoena.)

Under the guiding hand of the Oppenheimer family, De Beers has indeed striven with ruthless efficiency to control supplies and thereby manipulate prices. By tradition De Beers's 125 carefully screened customers assemble ten times a year in London, Lucerne, and Johannesburg to attend "sights," where they buy rough stones. "Sightholders," as customers are called, are presented with an allotment of stones in a plastic zip bag inside a yellow plastic briefcase; they must buy the entire offering at the price named by De Beers. Take it or leave it—negotiations over stones or price are rarely allowed, except in the case of diamonds that weigh more than 10.8 carats.

In the past producers attempting to market rough stones independently have been mercilessly punished, sometimes by a selective flooding of the market with stones from the legendary stockpile in the vaults under De Beers's London headquarters. Yet today rival producers in Africa, Australia, and Canada are flourishing. Tony Cabengele's stones, as with every other legal buyer in Angola, are bought by a company controlled by Lev Leviev, an Israeli entrepreneur who, in the 30 years since he emerged from the Tashkent ghetto, has come far enough to *(Continued on page 20)*

Tragic History

[illegible] stalls [illegible] men shipped in almost a century ago to work the rich diamond mines at Elizabeth Bay, [illegible]. Many [illegible] out, such mines and the towns they [illegible] ated now lie vacant, with homes swallowed by the desert. Shifting sands [illegible] laid bare a field of human bones near [illegible], another abandoned Namibian mining town built on the backs of [illegible] workers who lived and died in [illegible].

Reshaping a Coast

Outside Oranjemund on the desolate Namibian coast, diamond miners push back the ocean with massive sand berms. Behind this seawall they've stripped away 60 vertical feet of sand to expose bedrock and unearth diamonds washed down from Africa's interior over the past hundred million years.

Thwarting Theft

Tons of rock roar through conveyors at the Orapa mine in Botswana, run by industry giant De Beers. In 2000 the mine yielded 2.5 metric tons of diamonds. The plant is designed so that workers never touch a gem. In Namibia workers are x-rayed daily (left) to check for concealed stones. Bruce Mitchell, who dives for diamonds off the coast of Namibia, is searched on every voyage, as is his vessel.

(Continued from page 13) drive De Beers into headlong retreat from Angola and threaten its traditional control of Russian production.

Changing its strategy in the face of the new competition, De Beers sold off half its five-billion-dollar stockpile in 1999-2000. (Last year the Oppenheimers turned De Beers into a private company and ceased releasing such information.) Prices have fallen although they have not collapsed, suggesting that supply and demand do indeed apply to the diamond market after all. In fact in late 2000 the De Beers sales team faced a shortage of rough stones and had to search for emergency supplies.

"DIAMONDS are not really a commodity like gold or silver," a leading New York dealer explained to me one day. "You won't buy a stone from a jeweler and then sell it back to him for the same price—he's not going to give up his profit. But they are definitely the easiest way to move value around. I know a guy who had to leave Iran at a moment's notice during the revolution there. No time to sell his house or get to the bank, but he had time to pick up 30 million dollars' worth of diamonds and walk away."

"They are a form of currency," remarked Mark van Bockstael of the Diamond High Council in Antwerp. "They back international loans, pay debts, pay bribes, buy arms. In many cases they are better than money." Monrovia, capital of Liberia, for example, is known as a mecca for money launderers seeking to turn questionable cash assets into diamonds that can then be easily moved and sold elsewhere. There have been unconfirmed reports that Osama bin Laden's terrorist organization, al Qaeda, made use of this operation.

As van Bockstael expounded on his favorite subject, we were strolling to lunch from his office in the city's diamond district, the heart of the world's diamond bazaar. Eighty percent of the world's rough gem-quality diamonds are traded every year along three short streets next to the Antwerp railroad station. The Antwerp district has extensions in many cities: West 47th Street in New York, London's Hatton Garden, the high-rise offices of Ramat Gan in Tel Aviv, not to mention the Opera House district in Mumbai (Bombay) and the other "diamond cities" of India, where, in a union of modern technology and cheap labor, 800,000 workers craft stones weighing a fraction of a carat into polished gems. Each of these business centers revolves around personal contact and connections, thrives on rumor and gossip, and cherishes secrecy. Multimillion-dollar deals are clinched with a handshake and the word *mazal,* Hebrew for "good luck." "So many secrets," sighed van Bockstael as we skipped to avoid a cyclist in a long black coat and a broad, flat, fur-trimmed hat. "Nothing is what it seems in the diamond business, and half the time you don't even know if *that's* true."

Diamonds are conducive to secrets. With only some exceptions, they give no clue as to where on or in the Earth they originated. Although the industry is moving toward a system for certifying the source of every diamond, the hundreds of millions of stones moving through the pipeline today are anonymous, shedding their history as they pass from rough to polished. But not always, as I discovered one afternoon in New York at the back of a well-guarded workroom in the heart of the diamond district in midtown Manhattan. There a master polisher named Motti Bernstein was working, bent over a scaife, a spinning disk that looks much like an old-fashioned record turntable. The surface of the scaife was coated with oil and diamond powder, and resting on the scaife as it spun was an oval diamond clamped at the end of a mechanical arm called a dop.

Two months before, when this diamond first arrived in the workroom, it had been an opaque, semirectangular slab, fatter at one end than the other. In addition the stone had been "frosted," meaning that its interior—and any imperfections it might contain—was hidden until the first cut had been made.

Bernstein lifted the dop and looked at the stone through his loupe. He did this every few minutes, as he has done with tens of thousands of stones in 30 years of working as a master cutter. Calculating the shape and size of polished gems that can be carved from a rough stone without losing too much material is the true art in cutting and polishing. For more than a month Bernstein had been patiently shaping this diamond into its present form, crafting its 58 facets so that light would reflect both from its surface and its heart.

This was no ordinary diamond. "Never in my life did I work on something like this," he said as he held it up for me to see.

The diamond was enormous—just over 102 carats, the size of an egg and the largest flawless oval-cut diamond in history.

"It's sweet material, soft on the wheel," purred William Goldberg, Bernstein's boss and a renowned dealer in the New York diamond business. "Sometimes a stone will cry as you put it on the scaife," said Goldberg, uttering a plaintive, screeching noise in illustration. "But not this one. God," he declared to the room at large, "is on our side."

Goldberg had bought the diamond over the phone from Tel Aviv. When it arrived, he had taken it out on his terrace so he could be photographed holding it. Diamonds can shatter if struck in the wrong place, so one man had lain full length on the flagstones beneath Goldberg's outstretched hands, a human cushion in case Goldberg dropped the rough stone.

Eloquent on the subject of its sublime qualities, Goldberg was now mulling possible names for the oval diamond Bernstein was polishing, one of four gems ultimately cut from the rough stone that had arrived from Tel Aviv. "Maybe the Beluga," he mused, "because it's the best of the best." He had no idea where the stone had originated before it surfaced on the Israeli diamond market. I asked him what the uncut diamond had weighed when he bought it, and he replied, "265.82 carats." The penny dropped. I had found an old friend.

Eight months before, in the late spring of 2000, a group of diamond miners had been hard at work in a wide, sandy pit south of the city of Mbuji-Mayi, the heart of diamond country in the Democratic Republic of the Congo. The pit was honeycombed with square shafts hardly wider than a grave and as deep as 20 feet. The dirt was hauled in buckets on ropes to the surface, washed, sieved, and picked over. It was backbreaking and dangerous labor, and sometimes weeks or months went by without any reward.

Most of the stones the diggers found were small—less than a carat. The few dollars they brought had to be divided up among the numerous interests involved in the dig, including the owner of the land, the financier who supplied the food, the guards, and the *creuseurs*, as diggers are called in Congo. Then at the end of May one of the creuseurs reached into the dirt and pulled out a stone weighing an unbelievable 265.82 carats. Their troubles were over—at least for a while.

The creuseurs who had found what soon became known as the "big stone" were determined to drive a hard bargain. After intense negotiations, they made a deal with a stocky, 37-year-old dealer named Alphonse Ngoyi Kasanji, a powerful force in the local diamond business. Rumor put the price at three million dollars, although Kasanji would never confirm

The World of Diamonds

Earth's diamond mines produce some 800 million stones—both gem quality and industrial—a year. Eighty percent of the diamonds destined for jewelry pass through Antwerp before they reach the cutting wheel. Laborers in India cut and polish nine out of ten gems; the majority will eventually reach stores in the United States.

to me how much he'd paid, perhaps because some among the original team of diggers might not have gotten their fair share. But he did have to bring in partners and cash from his extensive properties around the city to meet the asking price. Confident that he would be able to recoup his investment, he began to look for buyers. Bewitched by the stone's enormous size, he put it about that it might be worth as much as 20 million dollars. His troubles were just beginning.

In October 2000 Kasanji announced that the big stone had been sold to a German buyer for 17.9 million dollars—a price inflated enough to raise a few eyebrows in the industry. Surrounded by an eager entourage of partners, family, and assorted hangers-on, he was a constant presence in the lobby of the Hotel Memling in Kinshasa, the capital of Congo, waiting for news that the money had arrived in the bank. "Is it here, Monsieur Kasanji?" I would call out to him in the morning. "Today," he would answer confidently. But the money never did arrive, and eventually Kasanji decided to set off for Antwerp and sell the stone there. Unfortunately for him there was another player in the game.

At the time the big stone was discovered, Congo had been locked for two years in a civil war in which both sides were financing themselves with diamonds. The government in Kinshasa relied heavily on its revenue from Mbuji-Mayi's diamonds, roughly 25 million dollars a month. At the same time, the government's Zimbabwean military allies were seeking to turn a profit on their intervention by taking shares in a new Mbuji-Mayi mine. And in the eastern half of the country rebels and their sponsors from the Rwandan and Ugandan armies were either siphoning off diamonds themselves or taxing those that did.

Back in August 2000, desperate for arms to ward off a rebel offensive, Laurent Kabila, then Congo's president, had sold the exclusive right to buy diamonds in Congo to an Israeli firm for 20 million dollars. Local dealers immediately began smuggling stones over the border to evade the intrusive Israelis and the low prices they were paying. But poor Kasanji and his treasure were already too high profile to slip away unobserved, so at the direction of Kabila and the Israeli firm, he took the stone not to Antwerp but to Tel Aviv, where it ultimately

caught the attention of Gerry Rubens and David Delevi, William Goldberg's Israeli partners. For the stone Kasanji had claimed would bring 20 million dollars, Goldberg agreed to pay a more modest eight million.

DIAMOND WARS are not a new phenomenon. Long ago in southern India powerful kingdoms fought for control of the mines that made them rich. Both sides in the vicious Lebanese civil war of the 1970s and 1980s were subsidized by Lebanese traders and smugglers in the diamond fields of Sierra Leone. In those

Keeping Cold

To dig a new entrance to the Mir diamond mine in northern Siberia, workers need felt boots, fur hats, and pneumatic chisels that can hack through 1,400 feet of permafrost. A ring of vertical refrigeration pipes will keep the shaft frozen (and stable) as warm air rises from the mine below.

days no one outside the diamond business paid much attention to this trend, nor did the emergence in the early '90s of the Angolan rebel leader Jonas Savimbi as a major supplier of rough stones excite immediate outrage, despite the slaughter that quickly ensued.

In 1992, following the breakdown of a peace accord with the Angolan government, Savimbi sent his UNITA army to seize the diamond-rich Cuango valley in northern Angola. Over the next seven years, thanks to the efforts of 100,000 semi-enslaved diggers, he extracted perhaps as much as four billion dollars' worth of stones. The *(Continued on page 28)*

Arctic Legacy

A vast monument to the Russian diamond industry, the Mir pit spirals [illegible] feet deep into the Siberian landscape. Russia's first mine, it opened in 1957 and spawned an entire city. By the time the pit was closed last year, trucks were taking 90 minutes to climb to the surface — and Russia accounted for 20 percent of the world diamond supply.

Rough Treasure

Unchanged since their formation some three billion years ago, these rough diamonds range from one-quarter carat to ten carats in weight. Mined in Botswana, the gems will trickle into the global marketplace, their origins obscured forever.

(Continued from page 23) consequences of Savimbi's access to diamond money are abundantly apparent today. "Diamonds have been a curse on Angola. Without diamonds the war couldn't last so long," said Jeremias Belino as he stood in the wreckage of Kuito, his home city in the central highlands, pulverized into ruin by Savimbi's assaults and artillery barrages. De Beers's annual reports from the early '90s provide stark confirmation of this belief, laced as they are with self-congratulatory references to the company's success in buying up the stones marketed by Savimbi and thereby avoiding a glut on the market.

For years there were few complaints from the UN or any other authority about the trade's support of Savimbi. In December 1998, however, Global Witness, a small group of British environmental and human rights activists, entered the fray. Operating on an annual budget of less than $500,000, from a walk-up office in north London, the group published "A Rough Trade," a powerful and damning summary of the diamond industry's responsibility for Angola's misery, quoting, among other public sources, De Beers's indiscreet reports.

Nevertheless it was not the war in Angola but the gruesome atrocities of a rebel group in another African country that finally put "conflict" or "blood" diamonds on the map, threatening the industry with disaster.

In the mid-1990s the richest digging fields in Sierra Leone fell under the control of a rebel group called the Revolutionary United Front (RUF), led by a former army corporal named Foday Sankoh. By 1999 Sankoh and his men were smuggling tens of millions of dollars' worth of stones a year out of Sierra Leone through neighboring countries.

The RUF forces, many of them forcibly conscripted boys, maintained control of their operation by spreading terror among the local population. In a horrifically systematic manner Sankoh's soldiers ordered men, women, and children to line up with both arms outstretched, then hacked off the victims' hands or legs and hauled them away in sacks. As a way of deliberately panicking civilians it was more effective than mere slaughter.

As reports of the RUF's gruesome attacks spread, the outside world began to discern a connection between diamonds and children with missing limbs. Global Witness announced the launch of Fatal Transactions, a campaign by several organizations to alert consumers to the bloody side effects of the diamond business, just in time for the 1999 Christmas season. "That dazzling diamond necklace you buy for that special someone at a swank Fifth Avenue jewelry store may be funding the activities of a cannibal gang in Sierra Leone," declared the *New York Post* in November 1999.

This sort of talk, with intimations of worse to come, threw the industry and those who depended on it into panic. "If there is a boycott of diamonds," said Nelson Mandela, "the economies of Botswana and Namibia will collapse." Diamonds from the Ekati mine in Canada, a new and major source, were marketed as coming "from a land as pure as the driven snow" in advertisements showing maidens standing on icebergs—an implied contrast to the sweaty, war-torn jungles of Africa. The U.S. Congress began the process of creating legislation that would mandate stringent certification of all imported diamonds as "clean."

As it turned out, customers appeared undeterred by the controversy. The feared boycott did not materialize, and sales for 2000 were the highest on record. Nevertheless De Beers, seeking to shed at least its image as a monopoly and to introduce its own line of branded gems, announced that it would no longer be buying any African stones from mines it did not own. "Diamonds have to be ethically correct," Tracey Peterson, a De Beers spokesperson, informed me as we stood on the *Debmar Pacific*'s remorselessly rocking deck in the South Atlantic. "They are about love and emotion, soft issues."

ASSOCIATING DIAMONDS with love and emotion has long been the key marketing strategy for De Beers. Fundamental to the campaign is the famous slogan "A Diamond Is Forever"—embracing the twin notions of eternal devotion and eternal value. Sometimes De Beers advertisements are more explicit about the role of its product in the mating game: "Of course there's a return on your investment," ran one full-page offering just before Christmas 2000. "We just can't print it here."

De Beers may be single-handedly responsible for prompting, in less than a century, American, European, Japanese, and, increasingly,

Chinese women to expect the "traditional" gift of a diamond engagement ring as a matter of right. But myths that associate diamonds with love and devotion go back long before De Beers's marketing campaign.

In Indian mythology gems are considered to have a cosmic power in and of themselves. Astrologers advise clients on which gems to wear in order to alter their destinies, and diamonds, according to one practitioner I consulted in Hyderabad, exhibit powerful effects on love, procreation, and, by extension, immortality.

Given their supernatural powers, it is not surprising that jewels have deep religious significance in India. Thus it was that in a gold-plated Hindu shrine high in the hills above Tirupati northwest of Chennai (Madras), I found a god adorned in diamonds.

The ancient idol, nine feet tall and carved of black stone, stood at the end of a narrow passageway. This was Balaji, fast becoming the most popular deity in all India. In the line behind me, stretching back miles, tens of thousands of excited worshipers chanted his name, the sound competing with the roar of nearby machines sorting the donations—destined to be used for the temple's charitable enterprises—that poured into collection sacks at the entrance.

Balaji wears a colossal shimmering crown of diamonds. It weighs almost 60 pounds and contains no less than 28,000 stones. His hands are covered with more diamonds; his ears sport massive diamond earrings. Close by are a diamond-encrusted conch shell and discus, his traditional accessories.

As Nanditha Krishna, an elegant Chennai matron and ardent Balaji devotee, explained somewhat superfluously, "He likes diamonds." Among other examples, she cited the experience of a friend who had promised Balaji a valuable diamond ring and then thought better of it, only to have the ring violently sucked off his finger and into the collection sack by an unseen force as he entered the shrine.

Deposited in the brimming treasure vaults of the temple, the ring would have joined priceless relics of an era when India was the world's sole source of diamonds. Southern Indian kingdoms and empires grew powerful on the wealth pouring out of the alluvial mines of the eastern Deccan Plateau, much of which was deposited at Tirupati and other temples as offerings from devout rulers. Their religious obligations fulfilled, kings and princes indulged themselves with exotic jewelry in forms and settings similar to those bequeathed to the gods. Travelers from far-off Europe marveled at the profligate display of wealth at the royal courts. According to one awestruck 16th-century visitor, even the king of Vijayanagar's horse wore a "city's worth" of jewels.

High on a rock on the edge of Hyderabad stands the towering fortress-palace of the rulers of Golconda, sacked and ruined by the Mogul emperor more than 300 years ago and abandoned to the kites and kingfishers that soar over the silent battlements. Of all the old diamond kingdoms, this was the most famous, its very name still a synonym for riches centuries later. The Koh-i-Noor, the Hope Diamond, the Regent, and other stones famous for their dramatic and frequently bloody histories—the original conflict diamonds—passed through here before drifting to the outside world by way of purchase, bribery, theft, or conquest. The extraordinary "old-mine" diamond cuts and settings treasured by India's now powerless royal families—and the newly fashionable adaptations by modern jewelers—give a hint of former times.

In an ironic turn of the wheel, long after the Indian mines were played out and the last trader abandoned Golconda, most of the world's gem diamonds once again pass through India. Of the 800 million stones wrenched out of the world's diamond mines every year, most are tiny, a fraction of a carat. Until 30 years ago they were considered useful only for industrial purposes such as cutting edges and drill bits. Labor costs in the traditional cutting centers of New York, Antwerp, or Tel Aviv made it uneconomical to turn them into gems.

Then in the 1970s a group of Jains, members of a small but venerable Indian religion, set up shop in Mumbai and began to cut and polish very small diamonds for export. As time went by, they shifted their manufacturing operation to Surat and a few other provincial cities. A soft currency, some useful tax breaks, dirt-cheap labor—"we prefer to say economical labor," one of them corrected me—and tightly knit family networks all worked to the Jains' advantage.

These new arrivals on the diamond scene found supplies easy to come by. Not only did

India's Artistry

Uniformed workers spend ten-hour days polishing diamonds at the Blue Star plant in Surat. Now some 200,000 strong, Indian diamond workers have perfected the art of cutting tiny stones. Bought for $90, more than a hundred of these gems—each with 58 facets—can barely frost a strawberry.

De Beers begin unloading its stock of small stones, which came to be known as Indian goods, but the U.S. government also started to sell off its stockpile of industrial diamonds. The vast output of the Argyle mine, discovered in 1979 in northwestern Australia, consists almost entirely of very small stones. A further source opened up in 1996 when Boris Yeltsin sold a chunk of the Russian stockpile to raise cash for his reelection campaign. Jewelers, particularly in the U.S., quickly adapted to take advantage of this new source of cheap gems, marketing them for use in inexpensive settings.

So it is that many of the world's rough diamonds find their way to India, and so it was that I found myself in Old Surat buying diamonds in a street so crowded with traders that four-wheeled traffic has long since been banished. All around me serious-looking men were negotiating deals in rapid-fire Gujarati, while at my feet a child beggar carefully swept the dust in hopes of finding stray stones.

Amidst the roar of the Surat street market I was offered diamonds of every shape and color. Someone flashed a paper square of shiny table-cut black stones at me. Another showed me some canary yellows. Behind me there was an excited shout from the crowd: "Hey, bring your stuff, this guy's buying everything!"

I announced that I was looking specifically for "small whites," and soon I was squatting inside an open storefront, peering at a little pile of what looked like brilliantly shiny grains of sand. Magnified ten times by the dealer's loupe, the sand turned into a heap of perfectly cut "round brilliants," each one with 58 meticulously polished facets. It was hardly a less impressive sight than the great multimillion-dollar orb I had handled at Motti Bernstein's workbench back in New York.

"Six and a half thousand rupees a carat," said the dealer. That would be just under $140. After some rapid negotiations the price came down to 6,000 rupees, $125, and I was the proud owner of a folded square of paper containing 168 perfect little works of art. Each one had taken three hours to make, with the labor subdivided among three different workers. I felt that the craftsmen, recruited from a desolate farm district in the interior and earning about $80 a week, deserved more credit for these miracles of miniaturization.

I had seen the vast De Beers mines in South Africa and Botswana, the trading centers of Antwerp, New York, and Tel Aviv, not to mention entire countries wracked by diamond wars, but nothing quite so impressed on me the scale of the global diamond business as evening rush hour on Varachha Road. This is the main artery of the Surat diamond factory district, and at 8 p.m. it is a bedlam of honking cars, jam-packed rickshas, motorcycles, and hundreds of thousands of bicycles carrying half a million diamond workers. The closely guarded factories in which these people have been at work all day ("If people can get hold of diamonds . . .") vary from stifling sweatshops to more upscale establishments. One, Blue Star Diamonds, even dresses its workers in identical gray-blue uniforms and insists they park their bicycles neatly, front wheels all pointing in the same direction.

In the Blue Star conference room proprietors Anuj and Akshay Mehta were telling me of their ambitious move upmarket into larger and more valuable stones when I produced my little packet and asked their opinion. The brothers whipped out their loupes and began scrutinizing the diminutive gems as seriously as if they had been ten times larger. Finally, after assessing color and quality, they gave their best estimate: "Ten thousand rupees?" Smugly, I told them how much I had paid. They beamed at me approvingly. "Excellent price. You are a diamond trader now! Why don't you go back to the market and make a good profit?"

I was tempted, but in the end I kept my little cache, just to pore over from time to time. They are full of surprises.

Tradition

At a Jodhpur wedding the groom wears a diamond-studded *sarpech*, or feather ornament, owned by his family for generations. Diamonds in India and around the world today serve a universal role—as symbols of love.

MORE ON OUR

Check out diamonds in our Online Extra. Real? Synthetic? Conflict-free? **nationalgeographic.com/ngm/0203.**
AOL Keyword: NatGeoMag

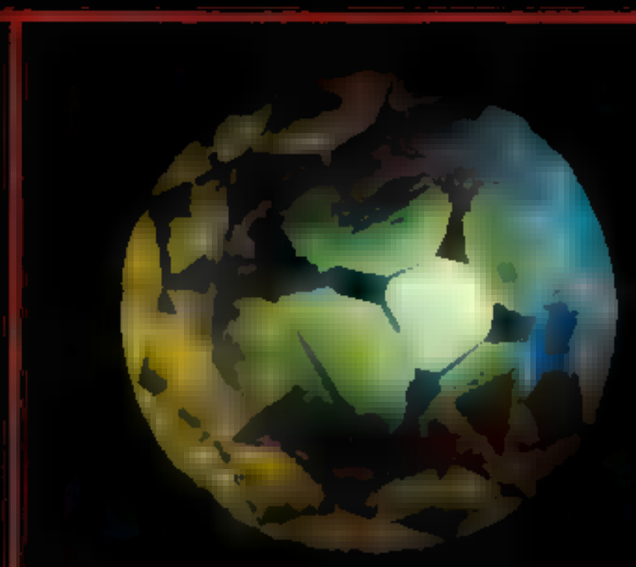

NATIONAL GEOGRAPHIC

Buyer Beware

Diamonds can be man-made or altered to enhance their worth. Either method is [illegible] as long as it's disclosed to consumers.

Synthetics

A diamond is simply crystallized carbon. Man-made diamonds are created by subjecting carbon to intense pressure and heat. Most synthetics show a distinctive pattern of color when viewed under ultraviolet light.



Laser Drilling

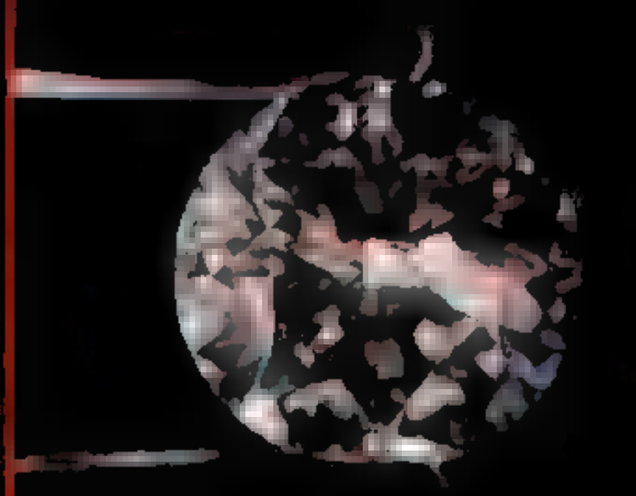
A laser beam can burn a tunnel through a diamond to reach dark spots, or inclusions, which diminish a stone's value. The laser hole is then filled with acid to bleach the imperfection, creating the illusion of flawlessness.

Colored Diamonds

Increasingly popular, colored diamonds are quite rare in nature. But irradiation or a combination of high heat and pressure can result in diamonds—either natural (top and top right) or synthetic—in a rainbow of tints.

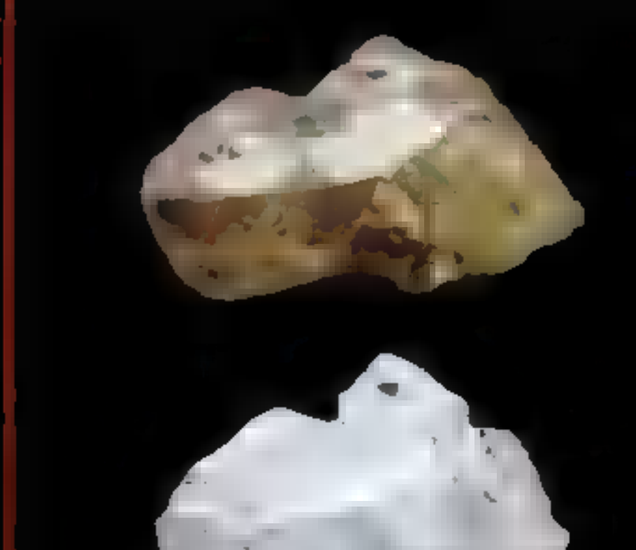
Fracture Filling

The white blemish on this diamond is a crack in the stone. Such flaws can be disguised when filled with a type of molten glass that refracts light much as a diamond does. Easily detectable, such fillings may be temporary.



Pressure Treating

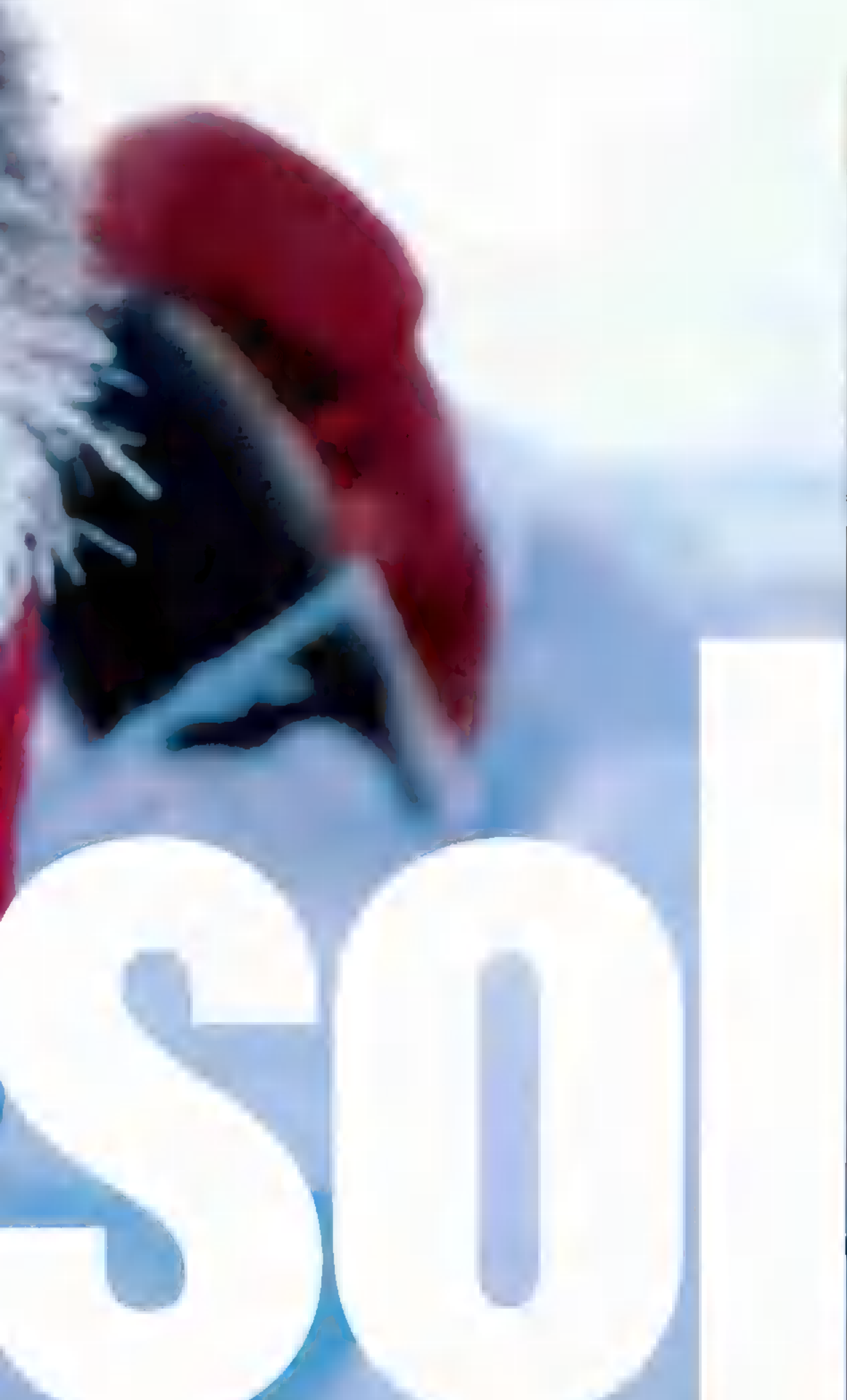
A normally brown diamond can become a highly prized "colorless" stone when subjected to extremely high heat and pressure. Trained gemologists can usually detect such enhancements.



Carved in Stone

Engraved by laser on the girdle of a diamond, letters, logos, serial numbers, or brand names can help identify a stone and its blood-free origin. Though increasingly common, such branding is easily erased by a few minutes of polishing. □

PHOTOGRAPHS BY SHANE [illegible] ELIZABETH [illegible] GEMOLOGICAL INSTITUTE OF AMERICA; [illegible] WOLINSKY [illegible] CARY WOLINSKY WITH [illegible] ELEN, [illegible]



BØRGE
OUSLAND
CROSSED
THE NORTH
POLE FROM
RUSSIA
TO CANADA.
THAT'S 1,240
MILES.
HE WALKED.
HE SKIED.
HE SWAM.
AND HE
DID IT

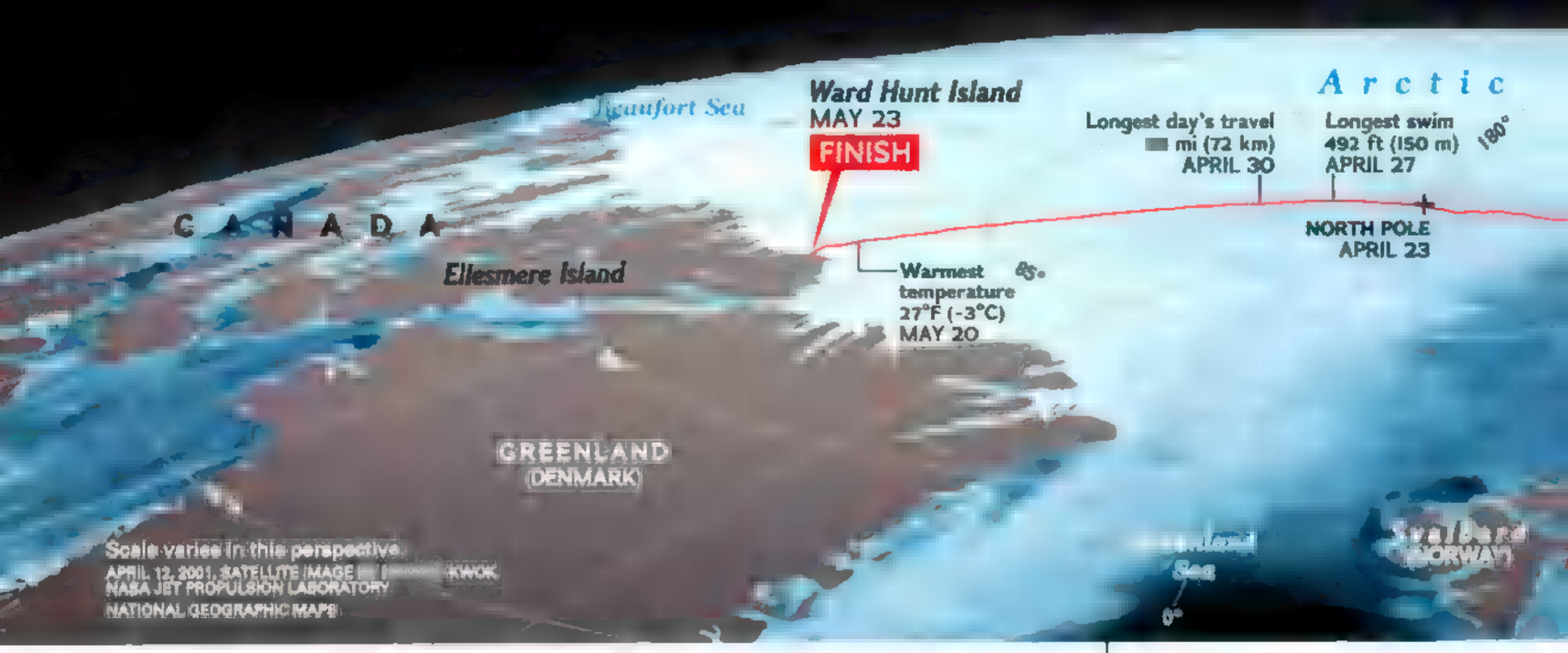
The first week of the last big solo expedition of my life nearly defeated me. I had prepared for two years. I was in top shape. I was motivated. I was battle tested (I had trekked alone to the North Pole in 1994 and across Antarctica by way of the South Pole in 1997). I was ready for a triathlon from hell, a 1,240-mile ski, walk, and swim from Russia to Canada, making me the first person to cross both Poles alone. But only days after pushing off, the sledge with all my supplies began to break: its rear cross-struts came loose, and its Kevlar coating cracked and was worn by the sharp edges of new pack ice.

I'd already survived one brutal night when the Arctic Ocean nearly swallowed my first camp (below). The next morning I couldn't find snow to melt for fresh water. Finally I spotted patches of frozen condensation on the leeward side of some tall ice blocks and scraped together enough for a cooking pot. A close call.

But what about the sledge? I spent day three trying to repair it with improvised tools, hand-drilling 140 holes and sewing damaged parts together. It didn't work.

ARTICLE AND PHOTOGRAPHS BY BØRGE OUSLAND

DAY 2 | Night of Terror
In the middle of the night I heard screams, squeals, deep grumblings. The ice was breaking, and the sounds came closer. Little sleep; got up several times to check. Woke to changed landscape—only a small patch of slightly thicker ice around my tent was untouched. I chose this site well.



This time I've also packed two items no one has used before on an expedition like this: a dry suit so I can swim across leads (below) and a sail to let the wind pull me along on my skis when conditions are right. On day eight I had the sail up for ten hours. I fell while maneuvering around pressure ridges—crests of ice forced up when ice floes collide. If I'm not careful, I could break a bone, the second biggest risk out here after falling through the ice.

That's what makes the Arctic so much more forbidding than the Antarctic: I'm always walking on frozen seawater. There's no land anywhere beneath me. Skis help distribute my weight, and I can put on my dry suit to give me a sense of security on thin ice, but whiteouts—snow blowing like frozen fog—often make it hard to see where ice is safe. Even when visibility is good, the ice has been so brutally chopped up I seldom get uninterrupted smooth stretches. Winds and currents conspire to smash floes together with such force that blocks are thrust 25 feet into the air.

I have to take off my skis and walk through rough sections. It's like scrambling

THE TREK

WHERE
CAPE ARKTICHESKIY, RUSSIA, TO WARD HUNT ISLAND, CANADA, VIA THE NORTH POLE

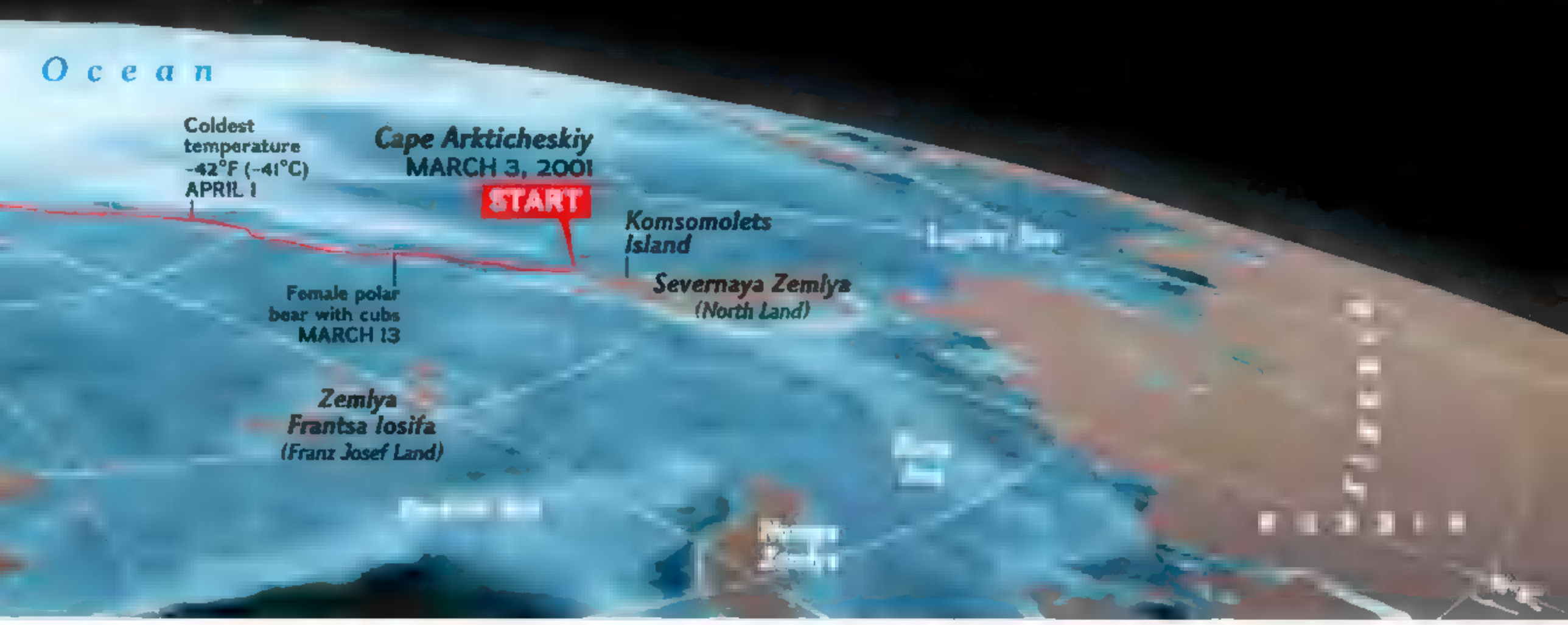
WHEN
MARCH 3 TO MAY 23, 2001 (82 DAYS)

HOW
SKIING, WALKING, AND SWIMMING WHILE PULLING A 365-POUND SLEDGE

DISTANCE
1,240 MILES
AVERAGE PER DAY: 15.1 MILES

TEMPERATURE
HIGH: 27° F
LOW: MINUS 42° F

MY WEIGHT
START: 214 POUNDS
END: 177 POUNDS



through bomb wreckage. When I find fresh pack ice, I measure its thickness with marks on my ski poles. The data I collect will help the Norwegian Polar Institute study global warming. I measured ice in '94 too; it's thinner now.

I've started to feel the layers of civilization peeling away; it takes weeks to find your animal self. I wake up, grunt at the sun, perform the day's chores, sniff the north wind, and automatically pick out the best route and the safest campsites—all without thought. I've found the rhythm. I think I can do this.

MORE ON OUR

Chill out with Børge Ousland — he reads aloud from his polar diary, and see — of his trek photos at **nationalgeographic.com /ngm/0203. AOL Keyword: NatGeoMag**

CROSSING TO SAFETY

All ice floes come to an end. You can't get to the North Pole without traversing leads. Polar survival lesson one: Cold water kills. If I fall in and get soaked, I won't survive more than a few minutes.

I say, work with nature, not against it. I try to think like an animal when I plan expeditions. What do polar bears do when they come to a lead? They swim. I worked with Norwegian gear manufacturer Helly Hansen to develop ■ polyurethane suit that could keep me dry, fit over my ski boots and mittens, and leave me enough freedom of movement to swim across leads. I tested it in the frozen fjord near my home in Oslo.

My time as an apprentice polar bear paid off. I was nervous when I slipped into the black water of the trek's first lead. But it worked. Nice and toasty. I swam across and pulled the sledge after me. The suit became my best friend; I christened it "Captain Nemo." The good Captain and I crossed 23 leads in all.

DAY 11 | Unwanted Visitors
I see polar bear tracks almost every day, so I'm in the habit of looking over my shoulder. Good thing: Today I saw a mother and two cubs in the distance. They walked straight for me. I pulled my gun, fired a warning shot into the snow, and they fled.

DAY 41 | Milestone
I celebrate my son Max's 13th birthday with a slice of home-made almond cake.

DAY 44 | The Big Hurt
Leaning forward to pull my sledge through pack ice strained my Achilles tendons. After days of agony I wrapped my feet and calves tightly in three layers of tape. It's working. Less pain—for now.

DAY 52 | The North Pole, Solitude's End
I arrive at the Pole, and I'm not alone—a jarring change. There are 25 others here, including Ibrahim Sharaf of Dubai, who dropped in via helicopter. I chat with him; a few pictures are taken. When his chopper leaves, I'm caught off guard by my feelings: They're going home, and I'm only halfway there.

on the way

BILL GASPERINI (BELOW)

"I have to build a new world for myself, gradually remold myself until I become part of the ice."

DAY 69 | Unforgiving

Somehow I pushed for [illegible] hours. [illegible] not good, [illegible]d, [illegible]. I need a rest day. The second half of my journey is more danger-ous. The ice is softer, and [illegible] affects [illegible] fox tracks. On [illegible] think as they do. [illegible] waste a step. They take the easiest path, not the shortest

the finish

MOST DAYS | More Tracks

[illegible] to the Pole in [illegible] saw [illegible] two [illegible] on the drift [illegible] is scarce? [illegible] effect? [illegible] careful. My [illegible] skis remind me: Get [illegible]

DAY 81 | End in Sight

Clear weather after weeks of [illegible] walk into [illegible] able [illegible] of [illegible]. Then I find a [illegible] that winds [illegible] the [illegible] and I can see Canada's mountains like a [illegible] teeth in the sun. [illegible] five miles from land.

DAY 82 | It's Over

[illegible] in the [illegible] pale light. Farewell to the Arctic Ocean. At three in the [illegible] I approached a small group of [illegible]. It was my girlfriend [illegible] in blue), my mother, and my old friend, photographer Kjell Ove Storvik. They had arrived by plane to meet me. "You look great," said Weems. I felt great, but when I stepped onto a [illegible] at a weather station on Ellesmere Island, I saw the truth: I had lost 37 pounds. Bandages covered raw frostbite wounds on my thighs. I think of the first week, when the sledge fell apart. This final trek's lesson: [illegible] even if all seems hopeless. [illegible]

KJELL OVE STORVIK
MIDDLE AND BOTTOM

Perhaps a million strong a century ago,
Attwater's prairie-chickens face
extinction as their numbers in
the wild dwindle into the dozens.
The last hope for this Texas
grouse: chicks born
and raised in
captivity.

down to a handful

By Douglas H. Chadwick
Photographs by Joel Sartore

We're near the point where the loss
of one more Attwater's could trigger
a final countdown.

Two males battle for the right to mate on one of the Attwater's last inlets, or breeding grounds. Last spring only 22 males were sighted; females keep too low a profile to be reliably counted.

Don't tell these chickens the sky isn't falling. The air is full of hawks that soar and circle, patrol and scan. Then they come plummeting in a rush of outstretched talons, fierce yellow eyes, and beaks like shears.

At sunrise I watched the Attwater's prairie-chickens transform from mottled grouse into ornaments that exalted the flat coastal plain of Texas. They struck a rigid pose, tail feathers held over their backs in spiky fans. Special neck feathers cocked up behind their heads like horns. On each side of the throat big patches of golden skin with magenta margins inflated like balloons, and extra gold flared over the eyes.

Strutting about, the performers bowed while deep notes boomed from the resonant air sacs. *Oo-loo-woo. Oo-loo-woo.* Then they boogied, each stamping his feet as though trying to drive them into the ground. You've seen this before—the tail fans, the thumping footwork—in Plains Indian dances, drawn from the courtship displays of male prairie-chickens gathered each spring on their booming grounds.

Suddenly the males have transformed again. Where a dozen paraded a second ago, I can't find one. Flattened with heads stretched out on the sod, the birds seem to have melted into it. Why? A hawk just swept by.

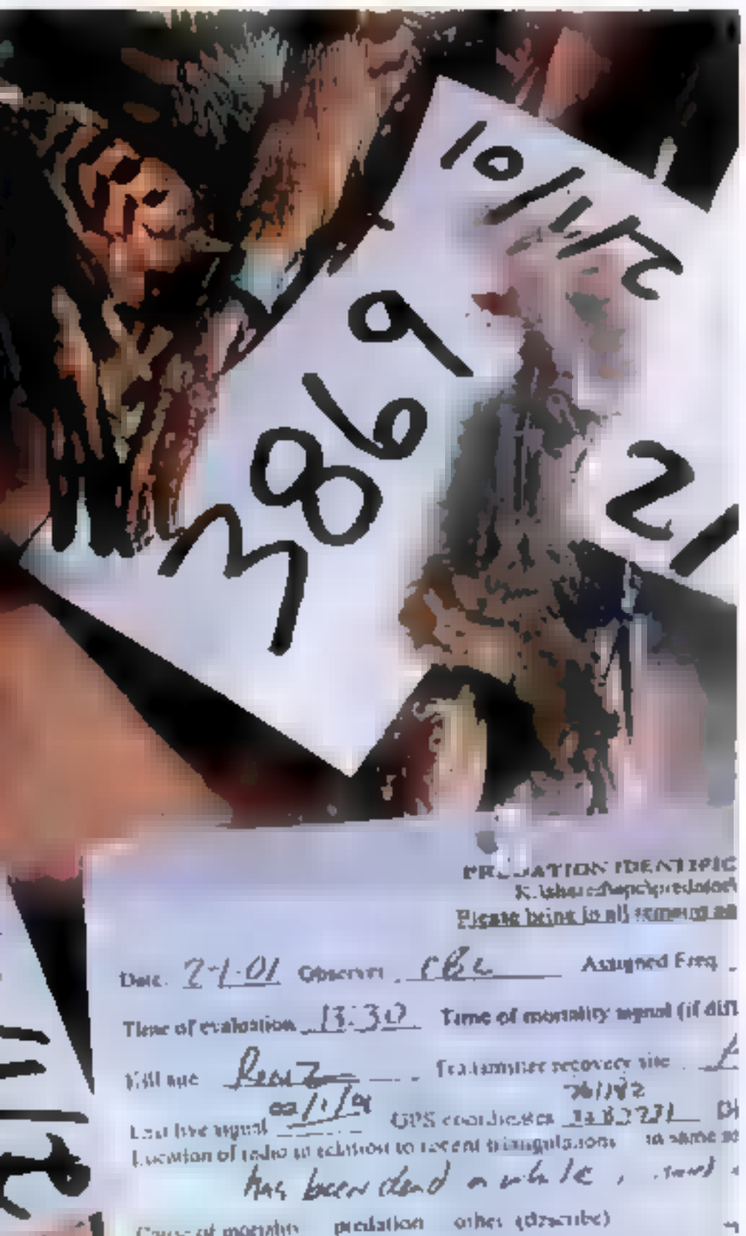
The sky *is* falling! This is no false alarm. There are about 10 other male Attwater's and 20 females left in the wild. They inhabit two separate grassy patches in Texas totaling 12,400 acres, the remnants of six million acres of coastal prairie that supported as many as a million Attwater's a century ago. The grouse were overhunted early and hit by habitat loss every year since.

Eastern North America held throngs of a close relative whose booming awakened early colonists. Called heath hens, they declined from the same causes. By 1929 one male remained. It endured for three lonely winters, and then the heath hen was gone. Now we're near the point where the loss of one more Attwater's

Assortment of Enemies

The first wave of assault came from hunters. Then farmers cultivated thousands of acres of prairie-chicken habitat. By 1937 a population of many a million birds had been cut to less than 9,000. Farm expansion, industry, and sprawl, especially around Houston (top), have since left the grouse with one percent of its original range. In the late 1980s three years of drought followed by three stormy breeding seasons decimated the species, wiping out 500 birds in one county. "Most biologists would never have guessed that that population would have gone so quickly," says biologist Mike Morrow. With fewer than 50 birds left on tiny islands of habitat, the greatest threat now is from predators such as hawks (far right) and owls, which leave severed heads as calling cards.

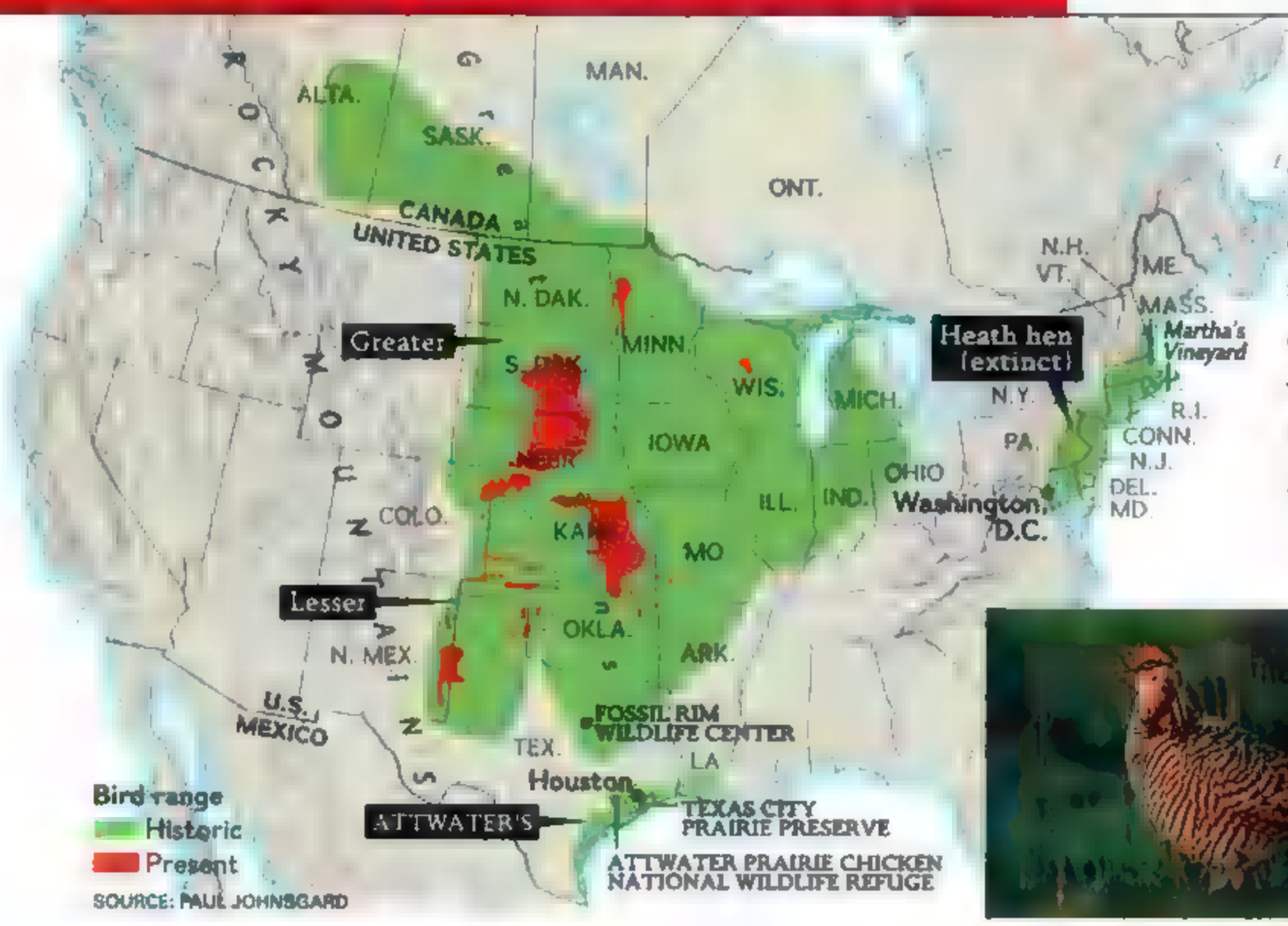
JOEL SABICUBI AND LIGHTHAWK



The problem is that the public hardly knows they exist.

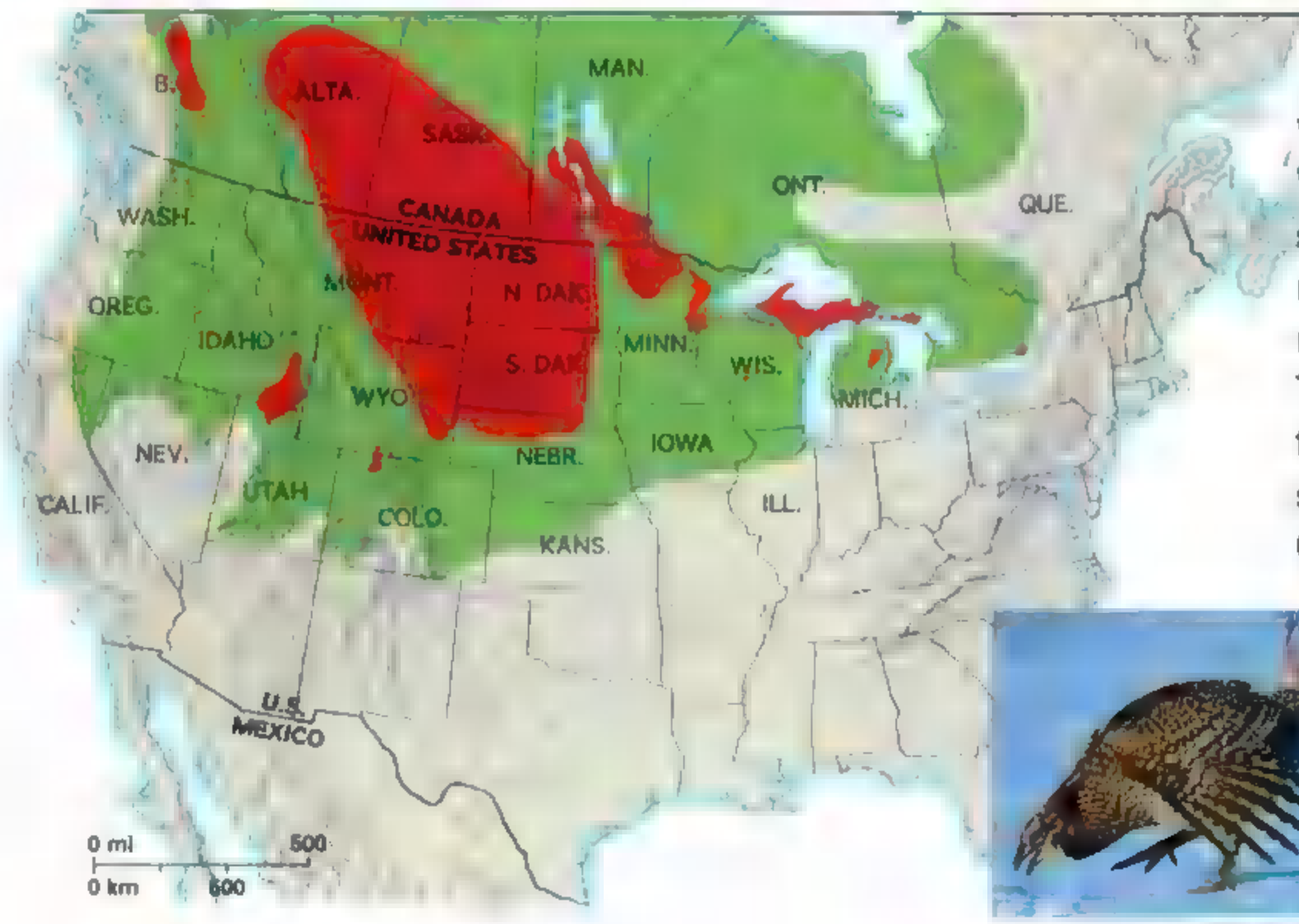
"It would help if they were named something else," says Matt Williams, an expert on the species. "People can't understand why you'd want to save a bunch of chickens."

Open Spaces Closing In



Prairie-chickens

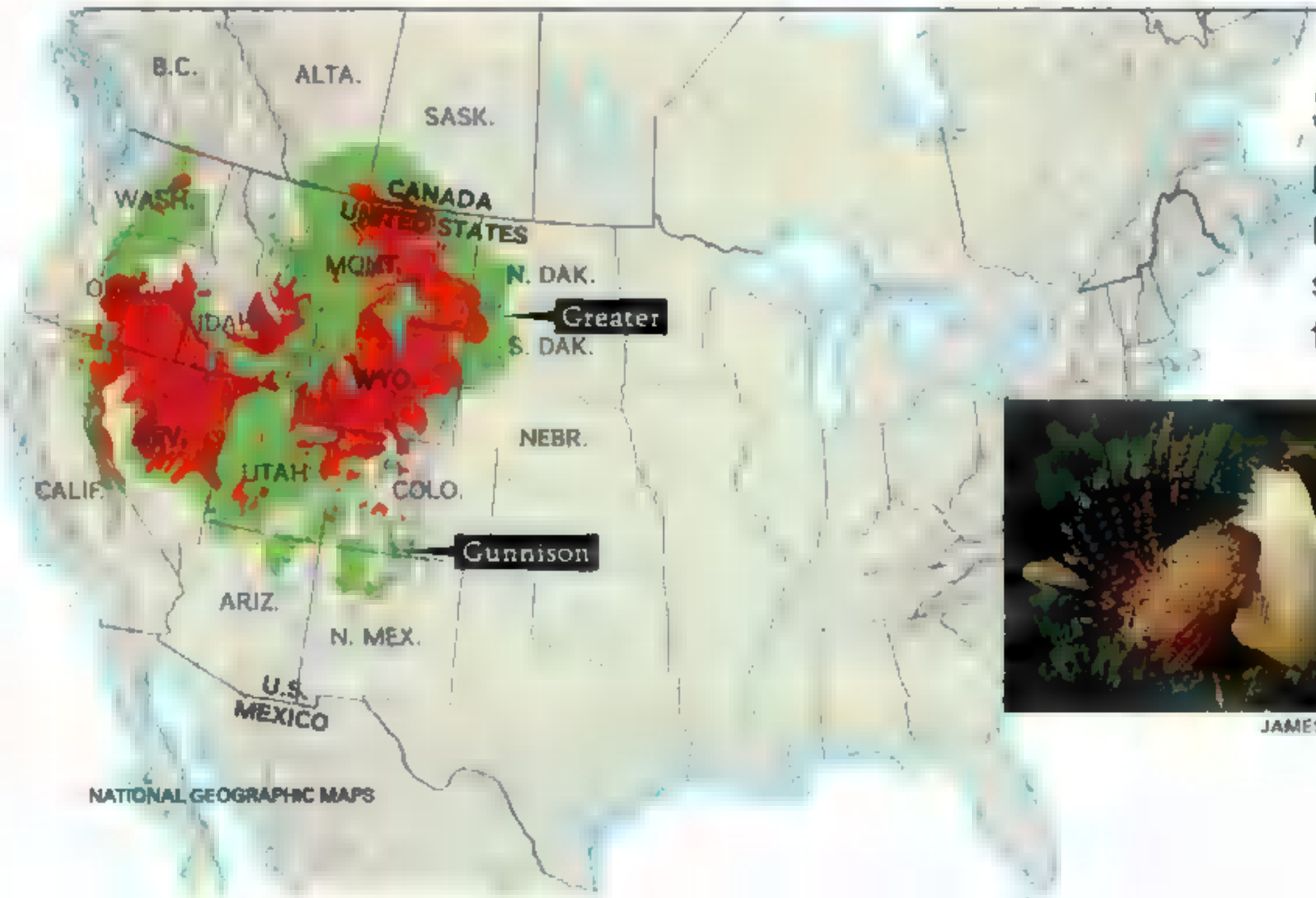
The Attwater's—named after an English naturalist who specialized in birds of southern Texas—is closely related to other grouse with the "prairie-chicken" moniker. Greater prairie-chickens are holding on in the heart of their range, but lesser prairie-chicken numbers are down 98 percent. The heath hen went extinct on Martha's Vineyard in 1932.



Sharp-tailed Grouse

With six subspecies, the sharp-tailed grouse is the most widely distributed prairie grouse in North America. The plains and prairie sharptail populations are relatively strong in the north, but the Columbian sharptail, ranging from the Rockies to the Pacific Northwest, is under siege because of habitat loss, according to the North American Grouse Partnership.

MICHAEL FORSBERG



Sage-grouse

Its numbers down by at least half in the past 20 years, the sage-grouse is a candidate for protection under the Endangered Species Act. Both species' ranges are dwindling, but the greater sage-grouse has recently rebounded in a few areas.

JAMES L.

to raptor, snake, skunk, disease, storm, starvation, collision with fence wire—anything—could trigger a final countdown.

Fifty miles due west of Houston, in Attwater Prairie Chicken National Wildlife Refuge, I was afield with the manager, Terry Rossignol, when three birds flushed at a distance, spooked by us. They were the first he had seen for months. He was still talking excitedly when a biologist came by with a plastic bag. In it were prairie-chicken parts, a tiny transmitter the animal had worn, and pellets from the owl that in all probability killed it.

Rossignol's shoulders slumped. "It seems that's how it goes with these birds," he said. "Good news, followed by bad news. Always a dark cloud hovering somewhere close by."

Enlisted to try breeding Attwater's in captivity, staff at Texas A&M University, four Texas zoos, Sea World, and another private wildlife facility called Fossil Rim learned how many steps in artificial incubation, rearing, and feeding can go haywire

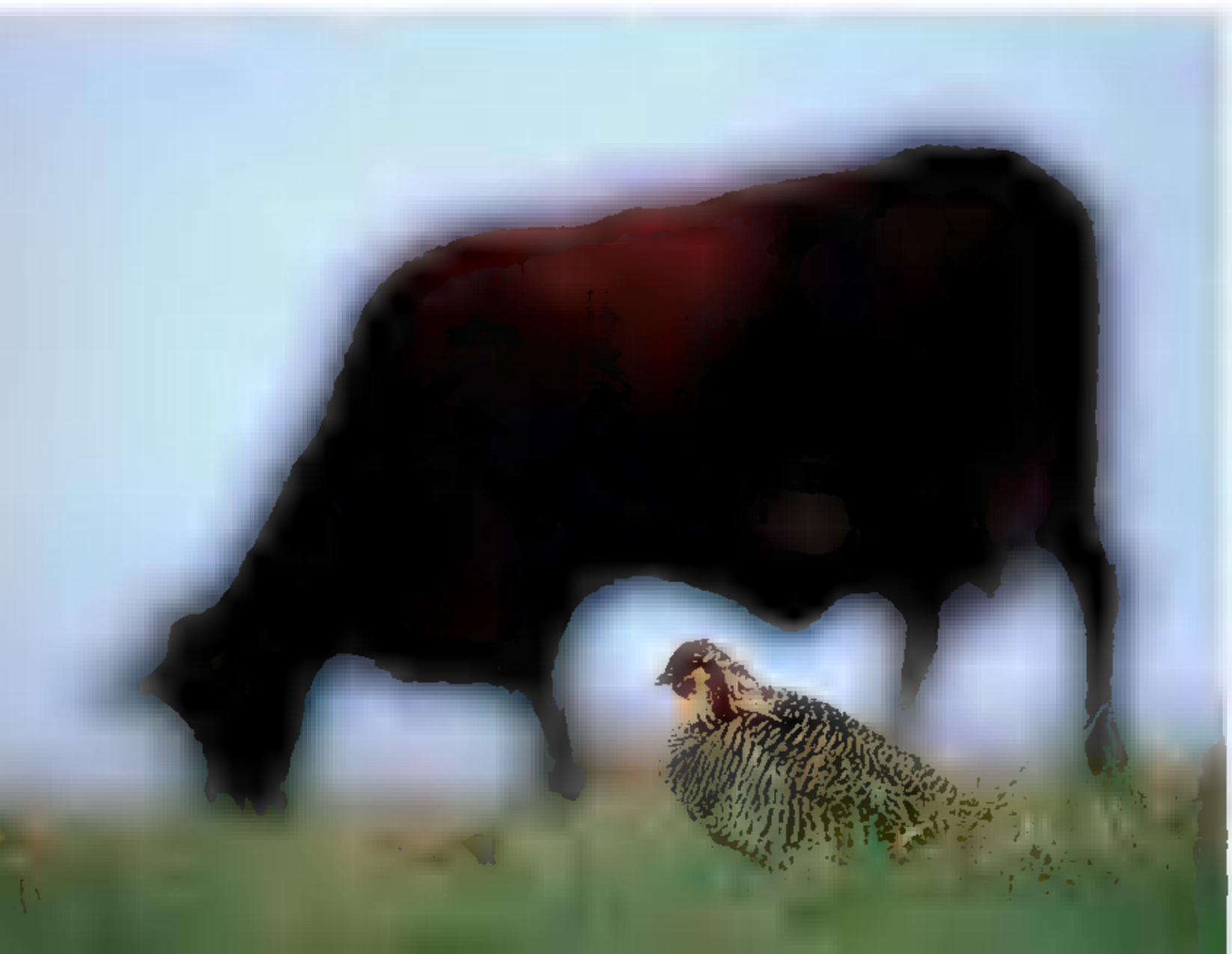
All Alone

In the mist of early morning a lone male inflates his throat sacs and struts his stuff on the Texas City Prairie Preserve. This field was once packed with Attwater's competing for mating rights. The country's only federal refuge, 80 miles to the northwest, fares no better.

in an 11th-hour rush. Still, their dedication yielded enough breakthroughs that they are delivering nearly a hundred young birds annually to the wild.

Good news, then bad: Only one or two percent of these newcomers have survived. This is partly because so much other wildlife, predators included, crowds into the same islands of natural prairie, tousled and flower-splotched within an expanding grid of rice fields, oil fields, overgrazed cattle pastures, and housing developments. Yet if it weren't for replenishment by captive-bred birds, the count in the wild would already be zero.

Trying a new tack, biologists placed several adult pairs in protected enclosures on the federal refuge. The hope was that the birds would become more familiar with the local environment and its dangers and that offspring would fare better under mother's watchful eye. I joined Dawn Blake, an AmeriCorps volunteer, as she delivered food and water to the pens. A



free-roaming male had been noticed around the cages, but she said that it would likely fly off as we neared. We were unlatching a pen door when a foot-tall figure strolled around the corner.

It was the male. I froze to avoid scaring him. No problem. He rushed at Blake in a golden-pouched, tap-dancing fury. He leaped up, grabbed her pants in his beak, and beat her calves with his wings. In my mind already named Raging Bull Grouse—definitely not Chicken—he then did the same to me. He sang, and he danced on our shoes. He shoved past our legs, trying to break into the pen and *Oo-loo-woo* the captive female. It took forever to squeeze through the door without him. This guy had no intention of going quietly extinct.

Don't count your chickens before they are hatched. Some eggs laid in the refuge enclosures went cold and rotten. Nests fell prey to snakes. Chicks just breaking out of shells were overwhelmed by fire ants. Other young disappeared within hours of release.

It isn't that the public doesn't care. The problem is that the public hardly knows that Attwater's prairie-chickens exist. Funding for field research and captive breeding therefore stays scarce. Plans to reconnect fragments of coastal grassland habitat gather little momentum. A unique, irreplaceable creation and its elaborate behavior, special adaptations, particular store of genes, and the daybreak beauty it fashions are fading out largely for want of attention. Look closely. Every one of America's plains and prairie grouse has been losing ground as well.

Like a lot of people I'm uncomfortable with good-byes. I stand around waving and uttering bland parting phrases when I feel all torn up and my mind is reeling with things left unsaid. I don't want to say so long to Raging Bull, to the shy hen that huddled at the corner of the pen, or to any of their kind. I'm not going to. There is not one reason why Attwater's prairie-chicken need disappear from a nation this grand, so full of innovators, and so willing to offer a hand once its citizens hear a clear call. Here it is: *Oo-loo-woo*. Why not go join the dance?

Last Chances

The future of the species basks in warm light at the Fossil Rim Wildlife Center, where more than ■ hundred Attwater's chicks are raised each breeding season. When the chicks are large enough to have a shot at surviving the wild, many are released into either of two sanctuaries—one run by the U.S. Fish and Wildlife Service and the other by the Nature Conservancy, which hopes to purchase more potential habitat. Only one to two percent of the released chicks survive the first year, but even this level of success keeps the species from quickly going extinct. It is too late to leave the Attwater's fate to nature. Managers at both reserves must rotate cattle grazing and prescribed burning to simulate the bison and wildfires that once kept the prairie healthy.

WHAT YOU [illegible] DO

Find out [illegible] you can adopt an Attwater's prairie-chicken or help save [illegible] species' dwindling habitat by [illegible] National [illegible] Extra [illegible]

[illegible] YOUR WEBSITE

You can [illegible] watch a video of the [illegible] chicken's dance, listen [illegible] its call—*Oo-loo-*[illegible] read notes from the field.

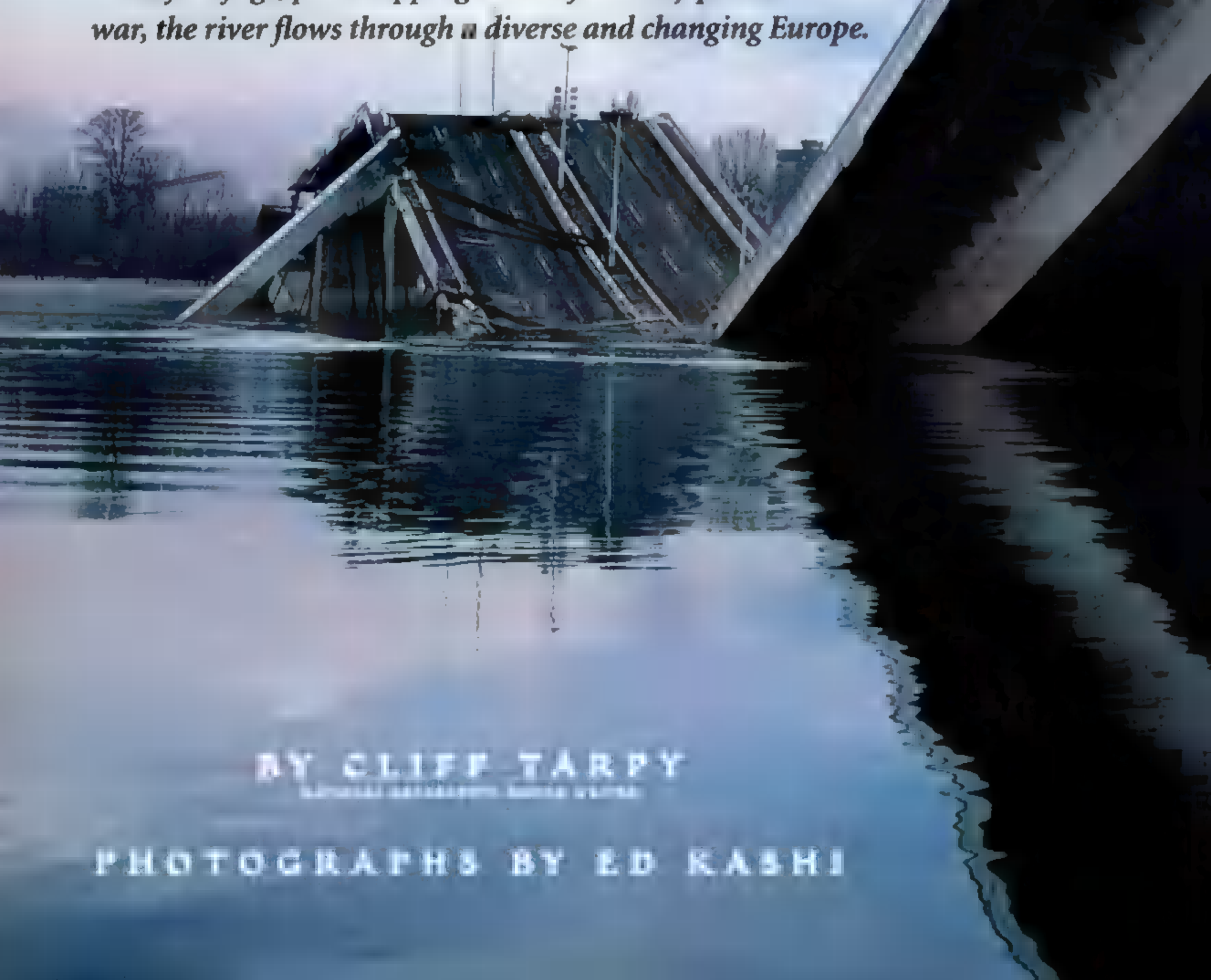
Long Odds

A captive-born mother and child were sent in a pre-release pen when this one's daughter was murdered, but danger was waiting when they ventured into the wild. A raptor killed the mother within a fortnight.

The Danube

Europe's River of Harmony and Discord

A ruined bridge in Novi Sad, Yugoslavia, bombed by NATO in 1999, strikes a jarring note on a river celebrated by the graceful "Blue Danube" waltz. Part romantic fairyland, part wildlife refuge, part shipping lane befouled by pollution and war, the river flows through a diverse and changing Europe.



BY CLIFF TARPY

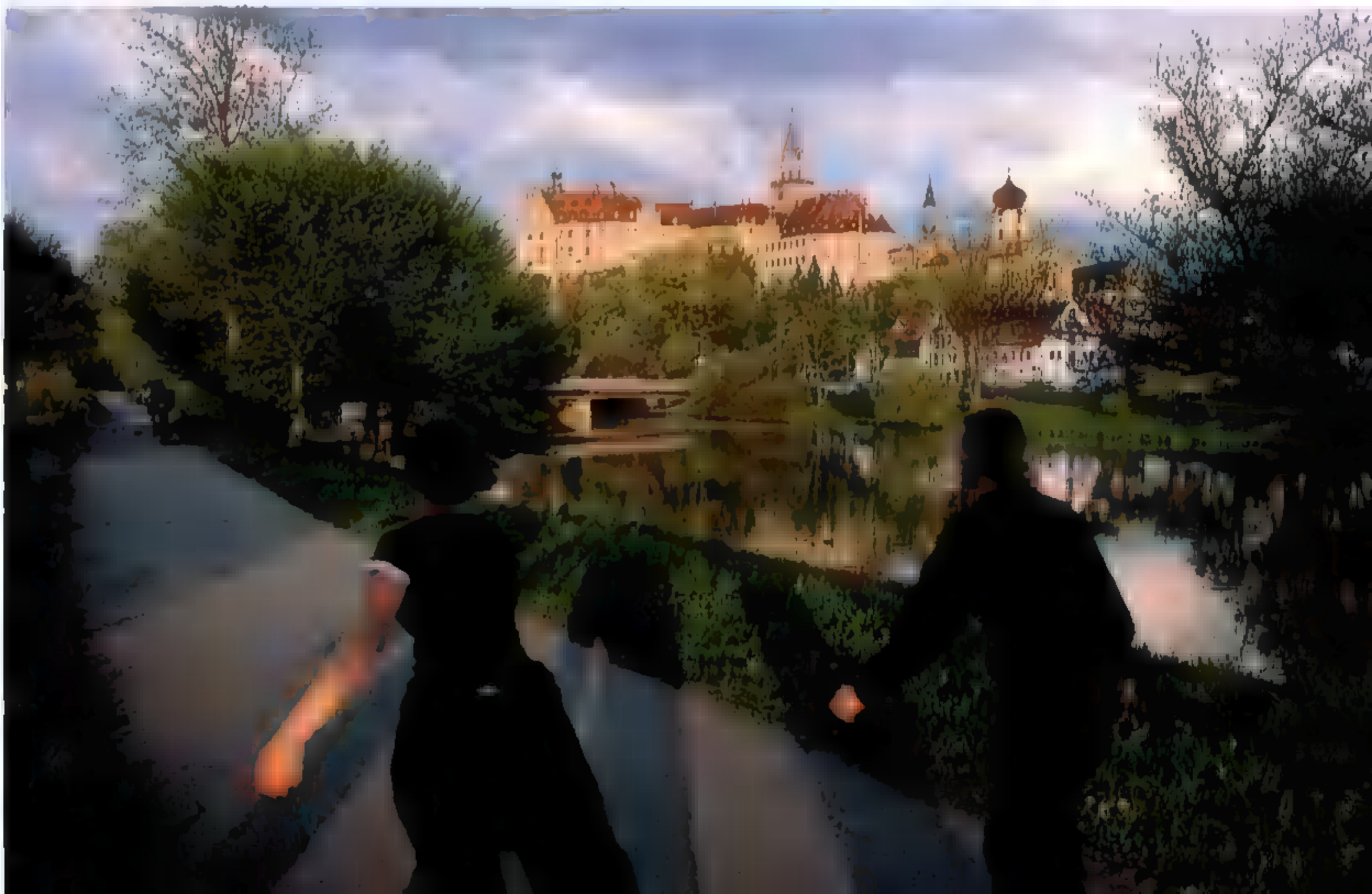
PHOTOGRAPHS BY ED KASHI

First it plies an idyllic course beside

A procession of faces and figures animates the Danube on its long journey through central and eastern Europe. On a lazy afternoon in May, boaters glide over the water near Kelheim, Germany, with their own musical accompaniment on board. Heading home as night falls, a worker walks on the levee of a fish farm near Călăraşi, Romania, after helping harvest the crop from ponds fed by the Danube.

tidy villages and storybook castles.

Fantastic masks have long served double duty in a festival held each year in Mohács, Hungary: banishing winter weather and, in the 16th and 17th centuries, frightening the Ottoman Turks, who had occupied parts of the country. As if in a fairy tale, Sigmaringen Castle rises beside a dreamy stretch of the Danube in Germany (below). A seat of the Hohenzollern dynasty, the medieval castle is still in use by the family.



SECURING THE BORDER

On the lookout for illegal immigrants, Austrian military guards scan the Danube and the shoreline of Slovakia beyond. Photographer Ed Kashi captured the view through a night-vision lens, at left, used for surveillance. Traveling from eastern Europe and Asia—mainly Pakistan and Afghanistan—immigrants seek political asylum or jobs in the West. Groups of as many as 30 people try to cross in rowboats or stow away on barges.

HIGHWAY FOR COMMERCE

A salute to the river takes place every April in Spitz, Austria, when local bands herald the opening of the shipping season. Upriver at Linz workers clean a barge (right) that delivered iron ore from South Africa. Cargoes of ocean vessels are loaded onto such barges, which are small enough to transit river locks.

SOMETIMES IT'S hard to tell where a river begins. It's doubly difficult with the Danube, born of two rival sources, both trickling down the slopes of Germany's Black Forest. But such ambiguity seems fitting, for the Danube is hard to pin down. Its name conjures graceful couples waltzing the night away in 19th-century Vienna, and for the first third of its nearly 1,800-mile journey to the Black Sea it plies an idyllic course beside tidy villages and storybook castles. But there is another Danube River, mainly in eastern Europe, one damaged by pollution and war. A NATO bombing campaign against Yugoslavia in 1999 destroyed industrial facilities, releasing contaminants into the water, and blew up three main bridges, which halted or diverted as much as a billion dollars in business.

But the Danube had a dual personality even before the bombing. The river is a playground for swimming and boating; it's also very much a working river of fishermen, barges, power plants, and shipyards. The working river is part of a busy transportation corridor connecting the North Sea with the Black Sea through the Main-Danube Canal, but it also feeds wetlands and valuable wildlife habitat. Today people along the river are striving to reconcile these competing demands and are beginning to undo years of environmental and war damage.

When I sought the river's source, an April snow shower greeted me on the farm of Hansjörg and Beate Heinzmann in the mountains of the Black Forest. Tapping the headwaters of the Brigach River, Frau Heinzmann held a blue-flowered pitcher below an opening in a stone slab near the farmhouse and then filled my glass. Downriver I would taste the wines of Austria. Here I swirled this cold, fresh vintage in my mouth. With just a hint of mineral tang, it was absolutely refreshing.

The Brigach has become a shrine for people from the ten countries through which the Danube flows. "We get a lot of visitors, mostly drop-ins," said Frau Heinzmann. When I stopped by at 11 a.m., 65 people had already visited that day. Drawing on the flow of travelers, the Heinzmanns have built a bed-and-breakfast on their farm.

A rival source lies near the city of Furtwangen, where waters of the Breg River flow through another stone marker next to a resort hotel. That stream has a stronger claim since it begins farther from the Danube's mouth. Underground streams from the Breg and Brigach meet in an ornate stone and concrete pool next to Fürstenberg Palace in the city of Donaueschingen. Only there does the river—Europe's second longest, after the Volga—take the name Danube.

I began following its course at Ulm, the first navigable point on the river, here patrolled by graceful swans. The world's tallest cathedral spire crowns Ulm's Gothic structure. From the top you can survey what was the medieval duchy of Swabia, one of a procession of powers —Celts, Romans, the Holy Roman Empire, Ottoman Turks, the Habsburgs, the Austro-Hungarian Empire, Nazi Germany—that has

held sway within the long Danube Basin. An outpost of the Roman Empire remains about 110 miles downriver at Regensburg, where walls of a fortress built in A.D. 179 still stand.

Leaving Germany, the Danube flows eastward into Austria, whose Wachau Valley is fertile ground for both piety and wine. Terraces of vineyards climb slopes as if to seek benediction from the great medieval monasteries that command the hilltops at Melk and Krems. The river passes castle ruins and apricot orchards that spangle the banks with snowy blossoms.

Wachau's scenery is captivating, but no place is as identified with the Danube's charm as nearby Vienna. At the Café Landtmann, where Sigmund Freud took his morning coffee, I savored a strong brew while sifting through racks of out-of-town newspapers. And in the shabbily genteel Liechtenstein Palace I took in a performance of the "Blue Danube" waltz, the melody that evokes Vienna the world over.

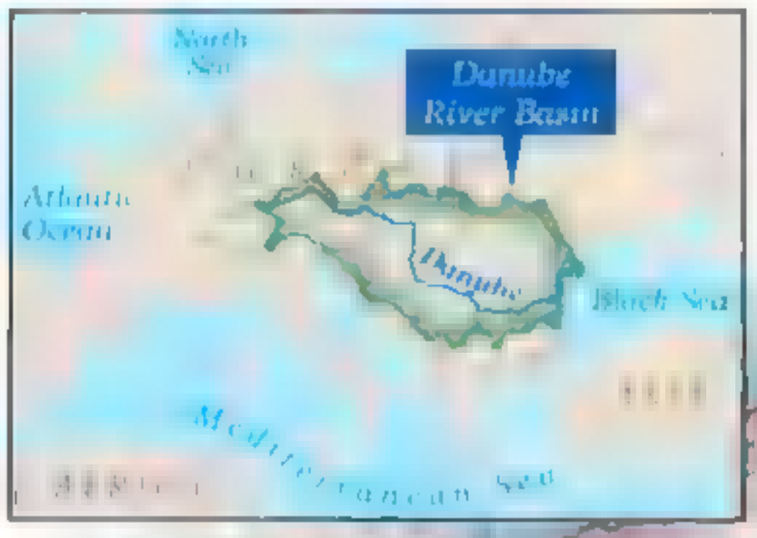
Vienna was a hub of the Habsburg empire, and in the 1860s, after Austria's defeat by the Prussians, Johann Strauss wrote the "Blue Danube" to cheer up his fellow Austrians. His music was "an evocative bow," wrote modern critic Harold C. Schonberg, to "a Vienna of young hussars and beautiful ladies, a Vienna of sentimentality and charm, a pretty-pretty and never-never Vienna of dance and romance."

Downriver from Vienna the Danube cleaves Hungary's capital of Budapest, with Pest on the left bank, commanded by the stately parliament building, and Buda on the right, crowned by Castle Hill, where King Béla IV built his stronghold against Mongol invaders in 1255. Between the banks sits Margaret Island, named for Béla's daughter, where I strolled paths flanked by gazebos, playgrounds, band shells, and young couples entwined on shaded benches like living statues.

Like other central and east European countries, Hungary shed its Soviet-dominated government more than a decade ago. But it's still

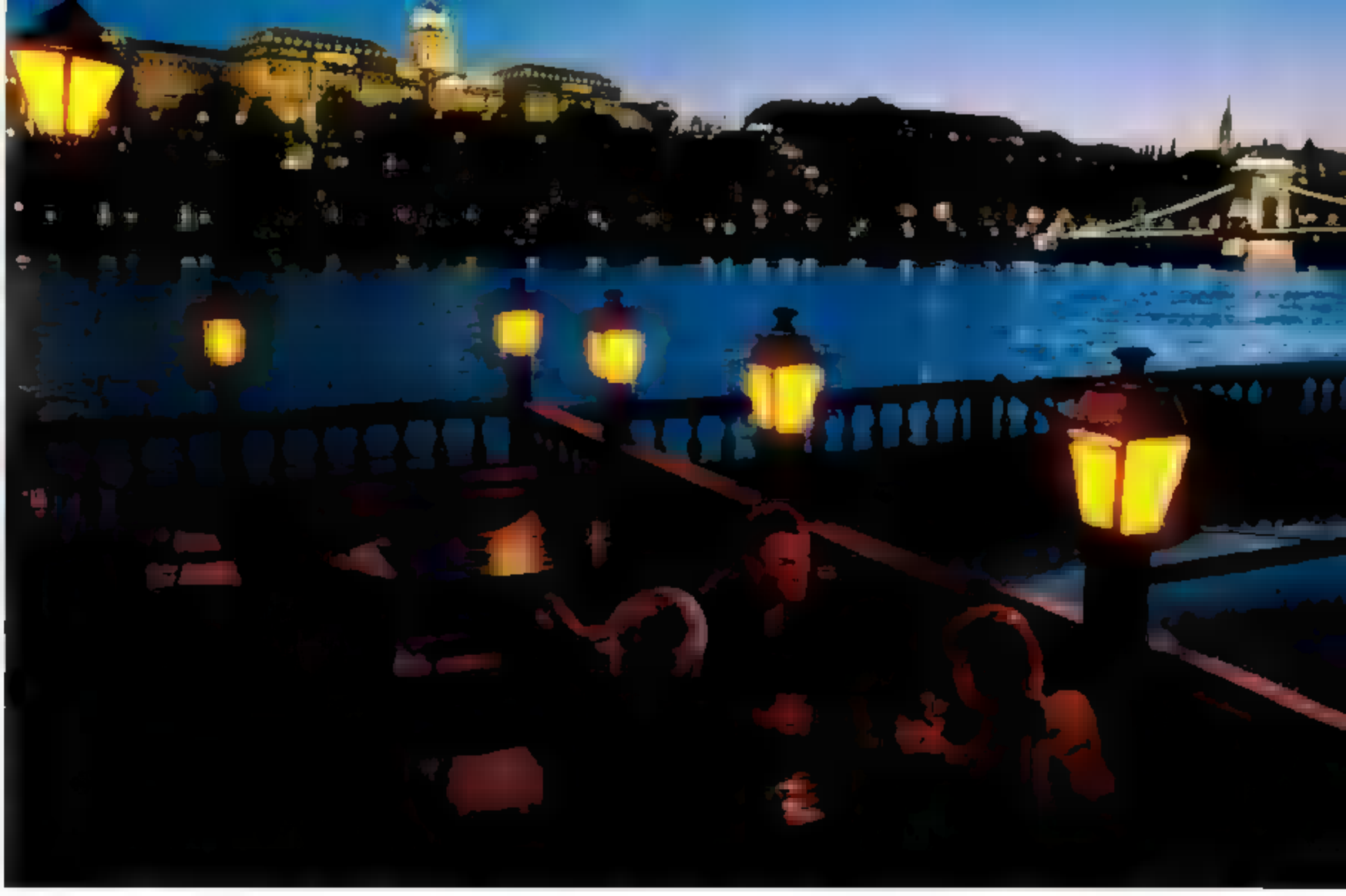
THREADING THE HEART OF EUROPE

Rising on the slopes of Germany's Black Forest, the Danube is known by a string of names as it courses through ten nations on its way to the Black Sea. Some 1,800 miles from beginning to end, it is Europe's second longest river, after the Volga.



DINING WITH A REGAL VISTA

A floating Irish pub provides a view of the fortress that crowns Budapest's Castle Hill. Festooned with lights, the Chain Bridge, at right, first linked the towns of Buda and Pest in 1849. At dusk the Danube—usually grayish green or light brown—shows its storied blue.



plagued by an international dispute rooted in the communist era. In 1977 Hungary and Czechoslovakia agreed to build dams—one by each country—on the Danube where it winds along their border. Czechoslovakia (which split into Slovakia and the Czech Republic in 1993) built a dam and a shipping canal that diverted water from the river, adversely affecting wetlands and water quality. But after Hungary rejected communism, concern about costs, water supplies, and environmental damage led it to halt plans for its dam. The result was a massive joint public works project only partly finished—symbolic of the conflicts that arise as a new post-communist sensibility struggles to be born.

SOUTH OF BUDAPEST I found the river in a happier state. At Duna-Dráva National Park I rode with park ranger Barnabás Felső in a small boat to one of the many islands in the park's flooded landscape. He pulled up to a fenced plot that he's turned into a kind of open-air retreat and toolshed. From the river he hauled a net that yielded four vigorously flopping fish he called golden ide, which were soon sizzling in a cauldron over a smoky fire.

Inside the enclosure Felső had erected reed platforms and shelves raised well above ground. "Those are to protect articles during floods," Felső said. "The water often gets this high," he added, holding his hand just below his heart. He already stood about eight feet above the river's surface.

As I ate crispy chunks of fish, Felső produced an aerial photo of his park showing irregularly shaped ponds connected by winding man-made channels. Centuries ago this system irrigated pastures and orchards growing dozens of varieties of apples, pears, plums, and cherries. Fish were raised in the ponds and trapped by wicker fencing when floodwaters receded.

The system declined in the 16th century, disrupted when a huge Turkish army crossed central Europe to secure the western reaches of their empire. By the end of the 19th century the serpentine Danube had been forced between dikes put up to create land for growing grains.

Back in the boat after lunch, Felső pointed

out rock piles that the park is spacing out on either side of the river in a staggered pattern designed to force the water to assume a more natural winding course, a result that will take up to two decades to achieve.

The river that day was broad and serene, colored dark green in the shade of half-drowned trees. "This environment is good for birds that need lots of water," Felső said. Indeed, the 122,000-acre park harbors an abundance of bird species. "We've got eagles, falcons, herons, and 40 pairs of black storks. This park may be their last chance."

South of Duna-Dráva scars of war began to appear, reminders of the conflict ten years earlier between Croatia and Serb-dominated Yugoslavia, which here face one another across the Danube. In Bilje bullet holes pockmark the headquarters of Kopački Rit Nature Park. From there biologist Tibor Mikuska drove me to a levee whose thick grass conceals countless mines left from the war.

Mikuska pointed to a path worn through the grass that led down along a safe section of levee to a concrete bulkhead. Such trails are left by anglers, and many of them were out that fine day, casting lines into waters teeming with fry. Commercial fishing was outlawed here in the 1970s, and Mikuska wants to restrict sport fishing to the park's least environmentally sensitive areas.

"The park should be open to the public, but people can no longer just go in and do what they want," Mikuska said. Shooting waterfowl is now outlawed, and park staff hope to limit big-game hunting. They are also training locals as nature-tour guides and encouraging them to open their homes as bed-and-breakfasts. "We want to make people proud of this area."

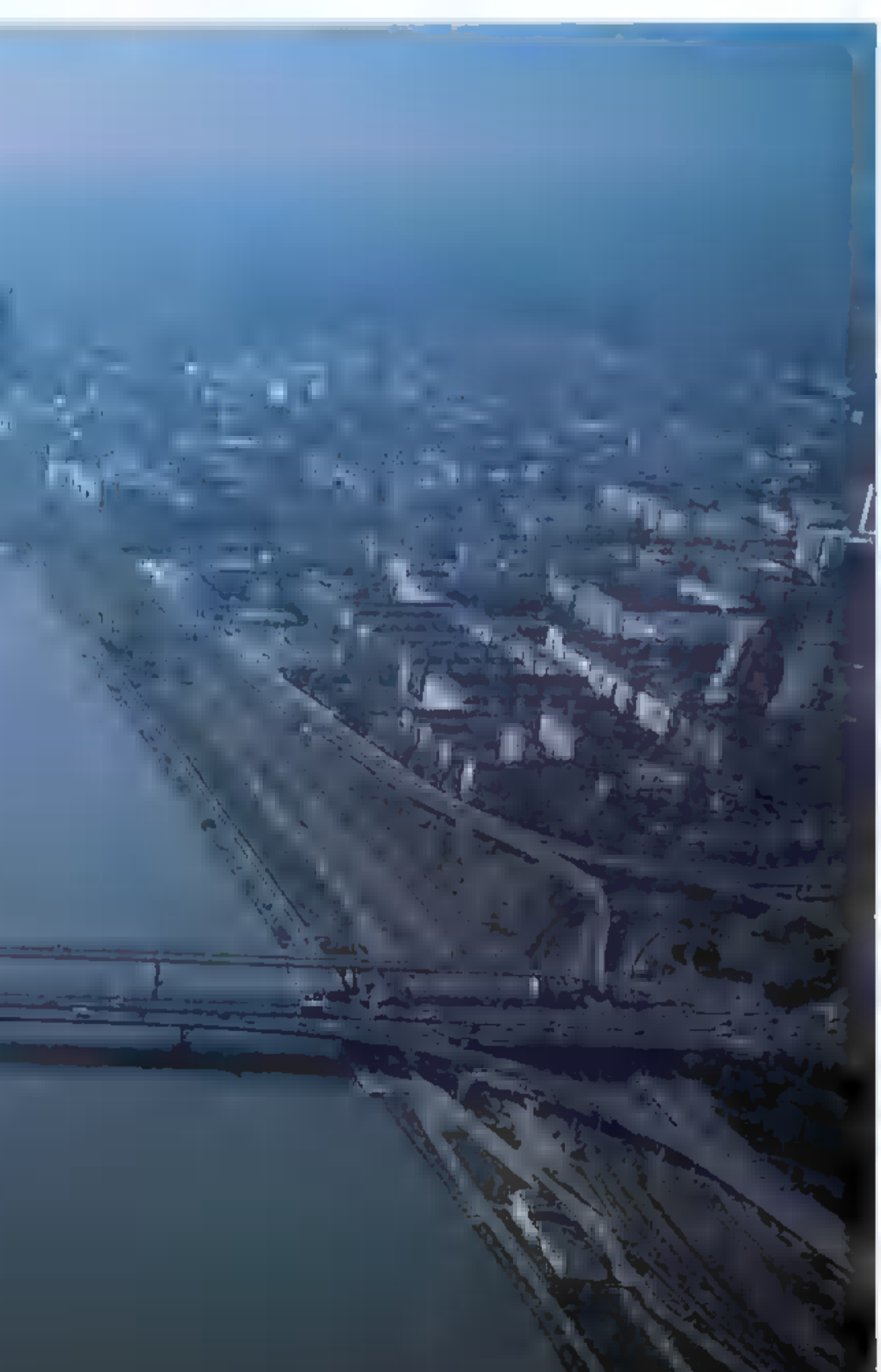
Kopački Rit and other Danube preserves

A playground for swimming and boating,

RIVER OF MANY MOODS

Challenging the torrent, a kayaker competes in a white-water contest in Slovakia. Water is churned by a cataract constructed as part of a flood-control and hydro-electric dam project. Calmer currents flow through Vienna, where Danube Island was created in the 1970s after the dredging of an adjacent flood-control channel. Today the island is a sports and recreation center threaded by bicycle and footpaths.

it's also very much a working river.



work under the rubric "sustainable": Steer locals away from practices that harm the ecosystem and encourage approaches that are less injurious but that still provide a decent living.

THE CONTRAST between Blue Danube nostalgia and reality couldn't be sharper than in Yugoslavia, which was bombed by NATO to halt President Slobodan Milosevic's attacks on ethnic Albanians in the southern province of Kosovo.

Sitting on the Danube 47 miles upstream from Belgrade, Novi Sad suffered mightily, with an oil refinery and three bridges destroyed. There, in a neighborhood of modest houses, a tearful woman named Jasminka Bajic smoked and drank tiny cups of strong Turkish coffee, recounting how she lost her husband, Milan.

"It was 12:20 a.m. on June 8, 1999," she recalled. "No one expected the bombs to hit that close to the houses." Milan was in the doorway of their home when a bomb landed across the road. "I had to sell all my cattle to buy the gravestone," she said. Jasminka now works as a janitor for a local labor union. As compensation for her husband's death, his employer built a new house for her and her two daughters.

Later that day at a small marina I met a fisherman named Velimir Teodorovic, who also

SCARS OF WAR

Hoop dreams spring eternal in the river town of Borovo, Croatia, where apartment houses remain pocked with bullet holes ten years after Croatia's war with the Serbs. Fighting broke out after Croatia declared independence from Yugoslavia, a federation of republics of which Serbia was by far the most powerful. A later conflict between Serbs and Albanians in the southern Yugoslavian province of Kosovo sent thousands of refugees to settlement camps along the Danube.

The river was serene, dark green

has vivid memories of the NATO bombing. In his boat we sped toward two enormous concrete slabs sticking out of the water.

The slabs, remnants of the Freedom Bridge, formed a V with its point below the surface. Teodorovic nosed the boat onto one of the slabs, walked up its surface, and pointed downriver.

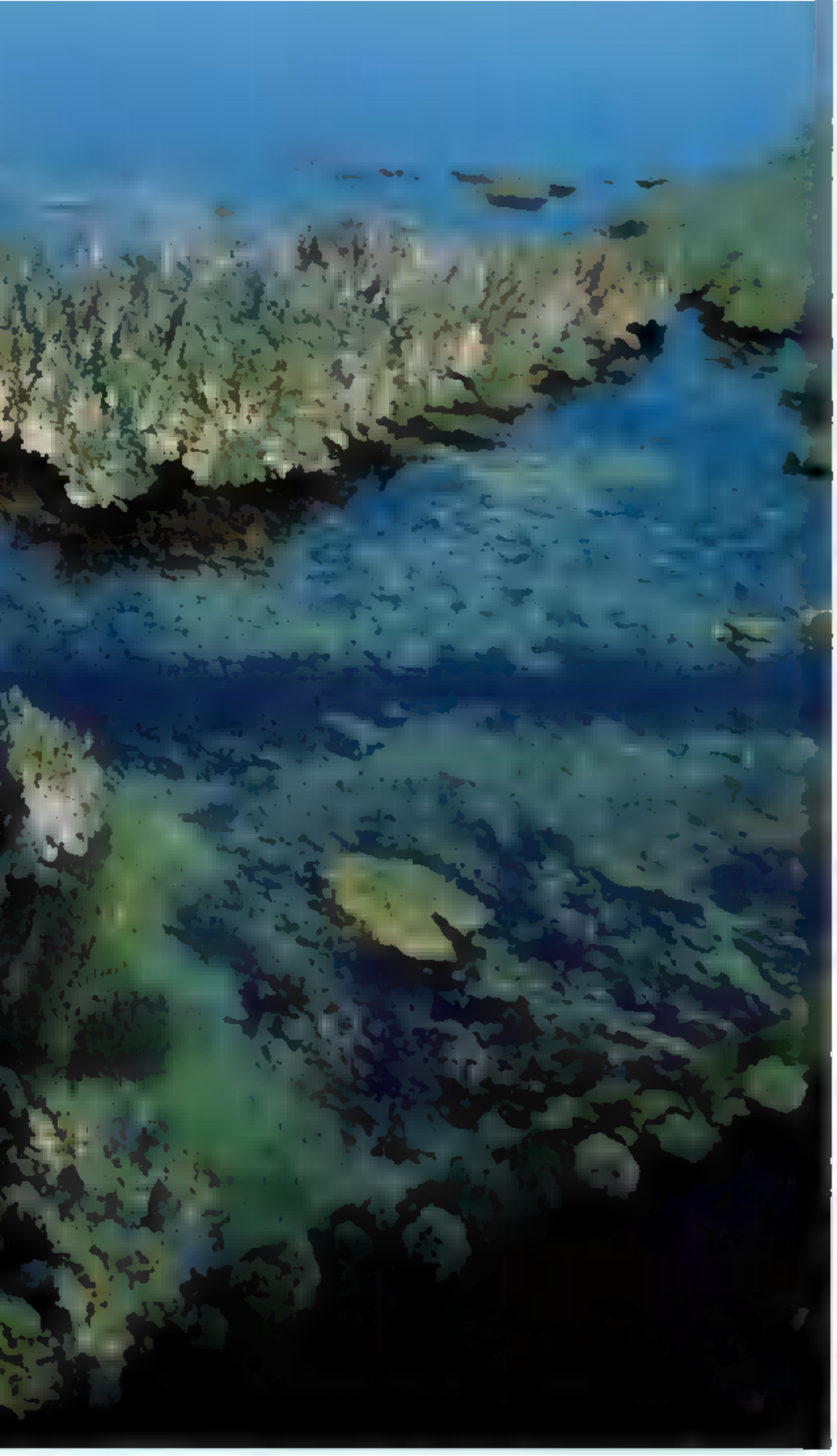
"I was right there, fishing for sturgeon and catfish, when the first rocket hit," he said. "People got out of their cars and started running back up the bridge, but I yelled at them to get into my boat because more rockets might hit." Sure enough, two more struck just after seven people scrambled aboard.

When we returned to the marina, I was struck by another Danube contrast: people in white lawn chairs under shade trees, drinking and laughing within the sobering sight of the bombed bridge.

The NATO attacks caused billions of dollars of damage and took a reported 500 lives. At risk were hordes of Serbian refugees who had fled from Kosovo to northern Serbia, where thousands remain. In Belgrade I went to a recreation center crammed with 33 refugee families. Small patches of territory, most of them no more than ten feet square, were partitioned with blankets and plastic sheets.

"I was the richest man in ten villages," Dobrivoje Mojsic, an elderly farmer, told me. "My family used to get along with the Albanians. One evening we were drinking coffee with them. The next evening they came to kill us." He said his life was spared only because a neighbor who owed him money paid it instead to Mojsic's captors for his freedom.

The 78 days of bombing left a mammoth job of cleaning up the river. Much of it has been



undertaken by the Budapest-based Danube Commission, funded largely by the European Union and nations in the Danube watershed.

"About a thousand ships were trapped, upriver and downriver from Novi Sad, in the ports of all the Danubian countries because of the bombed bridges," said Danail Nedialkov, the commission's top administrator. Besides the Freedom Bridge, two other nearby bridges were destroyed, then hastily replaced. A temporary pontoon bridge made of barges takes up some of the slack. It is opened to let ships pass, but navigation is still hindered because that is done only briefly a few days a week.

The commission has prepared an environmental impact statement for the river clearance, addressing such issues as neutralizing undetonated bombs and removing collapsed bridge sections—perhaps using explosives—without damaging historic sites or parklands.

Farther downriver, near Belgrade, the attacks crippled the city of Pancevo, destroying fertilizer and petrochemical plants and an oil refinery. The fallout: noxious gasses in the air and ammonia, mercury, crude oil, and petroleum derivatives in the river and groundwater.

"An environmental catastrophe," declared Borislava Kruska, Pancevo's mayor, who branded the bombings "a crime against humanity. The international community is

in the shade of half-drowned trees.

WATERING A FRUITFUL LAND

As the landowner pours her a glass of slivovitz, a Serb refugee from Kosovo takes a break from corn harvesting in Yugoslavia. Feeding a haven for wildlife, the Danube meanders through Kopački Rit Nature Park (above left) in Croatia. Downriver, Romania, Bulgaria, Moldova, and Ukraine are working to restore habitat in a cross-border green corridor of wetlands, meadows, and floodplain forests.

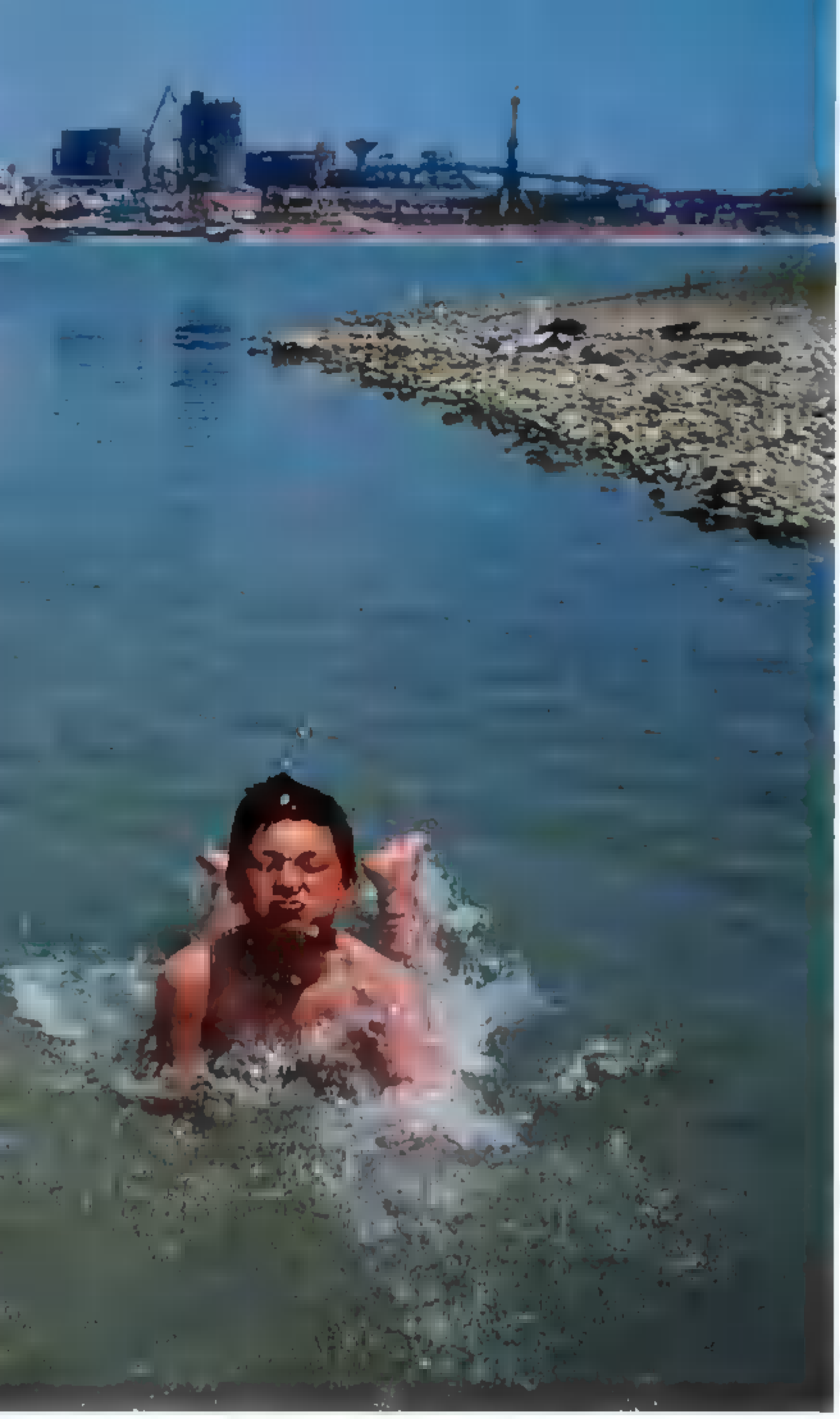
primarily concerned about Novi Sad bridges not because of our suffering but because they want their navigational route opened."

There's no doubt that clearing the river has high priority for the Danube nations. Ocean-going ships off-load onto river vessels at Galaţi, Romania, and the bridge downings far upstream are costing Romanian shippers ten million dollars a month in lost business.

The bridge disaster affected people of all incomes. In the town of Tutrakan, Bulgaria, on a hill overlooking the Danube and Romania across it to the north, 65-year-old Dimo Kovachev sat idle on a tree stump. Below, on the waterfront, sat the town's crane, which he operated before retirement five years ago. It was also idle. "There's just no work here," he said. "People hang out on the streets. The crops are good, but people can't afford to buy things." Fishing has declined because of environmental degradation and habitat loss. "Thirty years ago I caught four kinds of sturgeon in the Danube." That was before wetlands on islands and along the riverbanks were diked to create cropland. "In spring, when the water was up, the marshlands flooded," providing a place for fish to spawn. "If the marshes are restored, the fish will come back."

That kind of habitat restoration is the goal of three young Bulgarians—Edita Difova, Ivelin Ivanov, and Gradimir Gradev—who work with Green Balkans, a federation of environmental groups. Downriver from Tutrakan the trio gathered one evening atop a concrete bulkhead, part of a system of channels that alternately drain and irrigate a broad swath of former marshland to make it suitable for growing corn and wheat.

"Our goal is to restore the wetlands by cutting the levees, which were built up in the 1950s, and allowing the water back in," Edita said against the sound of cuckoos and a chorus of frogs. Green Balkans owns two abandoned fish farms that it hopes to flood as nationally



TOXIC SKYLINE

Youngsters swim next to the Bulgarian riverbank across from Romania's Turnu Măgurele fertilizer plant. Pollution in and along the river plagued the Danube nations of eastern Europe during the communist era, a legacy that new governments are working to undo.

protected wetlands, primarily as waterfowl habitat, a plan for which the group is seeking private and government funding.

As Edita walked along a dirt roadway, two pygmy cormorants and a flock of white herons flew by in the waning sunlight. A small deer bounded through the fields. "These are second-growth forests," she said. "We're applying for funding to reintroduce the natural species, mainly on the islands."

Among those islands is Belene, site of a Cold War–era prison where political dissidents were tortured and killed. Belene today remains a prison farm. A scowling young guard opened the gates onto a pontoon bridge that carried us on a teeth-chattering drive to the island. Armed guards are always around, but prisoners move about the island unrestrained as they tend crops and livestock.

"This is one of the the biggest and best conserved marshlands in the area," said Edita, who prizes Belene because of its habitat for pelicans, threatened eagle species, herons, and cormorants, and for mammals such as wild boar.

ON THE COAST of the Black Sea lies the river's biggest wetland: the Danube Delta, a labyrinth of channels, streams, oxbows, lakes, forests, and dunes that provides habitat for more than 300 bird species.

This watery land has only a handful of small villages and one city, Tulcea, Romania, from which the delta fans out with three main channels. Sulina Channel, the route for oceangoing vessels, has been dredged and straightened to create a virtual beeline east to the Black Sea.

Only a boat small enough for narrow, shallow waterways can reach the delta's secret places. My craft was a red-and-white runabout called *Gipsy*, piloted by a rangy, square-jawed young man named Adrian Cacencu. He took me on speedy, exhilarating rides along back channels. We also slowly motored past day huts fashioned by fishermen out of reeds, through marshes where coots skimmed the water, and across lakes that exploded with flights of pelicans.

After we overnighted in the small port of Sulina, I asked Adrian to take me to the Danube's end. We set out just after dawn, with the waves growing bigger and choppier as we went east. *Gipsy*'s hull smacked down harder and harder. With cold, salty spray in our eyes and the lighthouse on our right, we knew we'd hit seawater.

We crossed over to the south channel, passing cows and bulls munching grass on the banks. Then it struck me: The Danube had shown me a variety of colors but never really blue. But here, filtered by the delta's reed beds, the water was a deep, dark indigo. Far from Vienna I had found the beautiful blue Danube. If *Gipsy* hadn't been so small, I might have stood up and danced. □

MORE ON OUR WEBSITE

Find our research staff's guide to Danube-related resources at **nationalgeographic.com/ngm/0203**.
AOL Keyword: NatGeoMag

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The workweek draws to a close on Friday evening for fishermen of the Danube River Delta. During the week these men stay in simple shelters they've built along the banks. Having sold their catches to local buyers, they connect their boats with lines and wait for a tugboat that will pull them on a two-hour trip to their homes upstream. One boat holds bundles of newly harvested reeds.

The Danube Delta, located mainly in Romania at the end of the nearly 1,800-mile-long river, is the third largest delta in Europe. It covers 891,670 acres rich in forests, lakes, marshes, and dunes threaded by streams and channels that empty into the Black Sea. A wetland of international importance, the delta is included in UNESCO's Man and Biosphere Program and contains a World Heritage site. To protect animal and plant life, sensitive areas are off-limits to people.

BY CLIFF TARPY
NATIONAL GEOGRAPHIC SENIOR WRITER

PHOTOGRAPHS BY ED KASHI

THE DANUBE DELTA

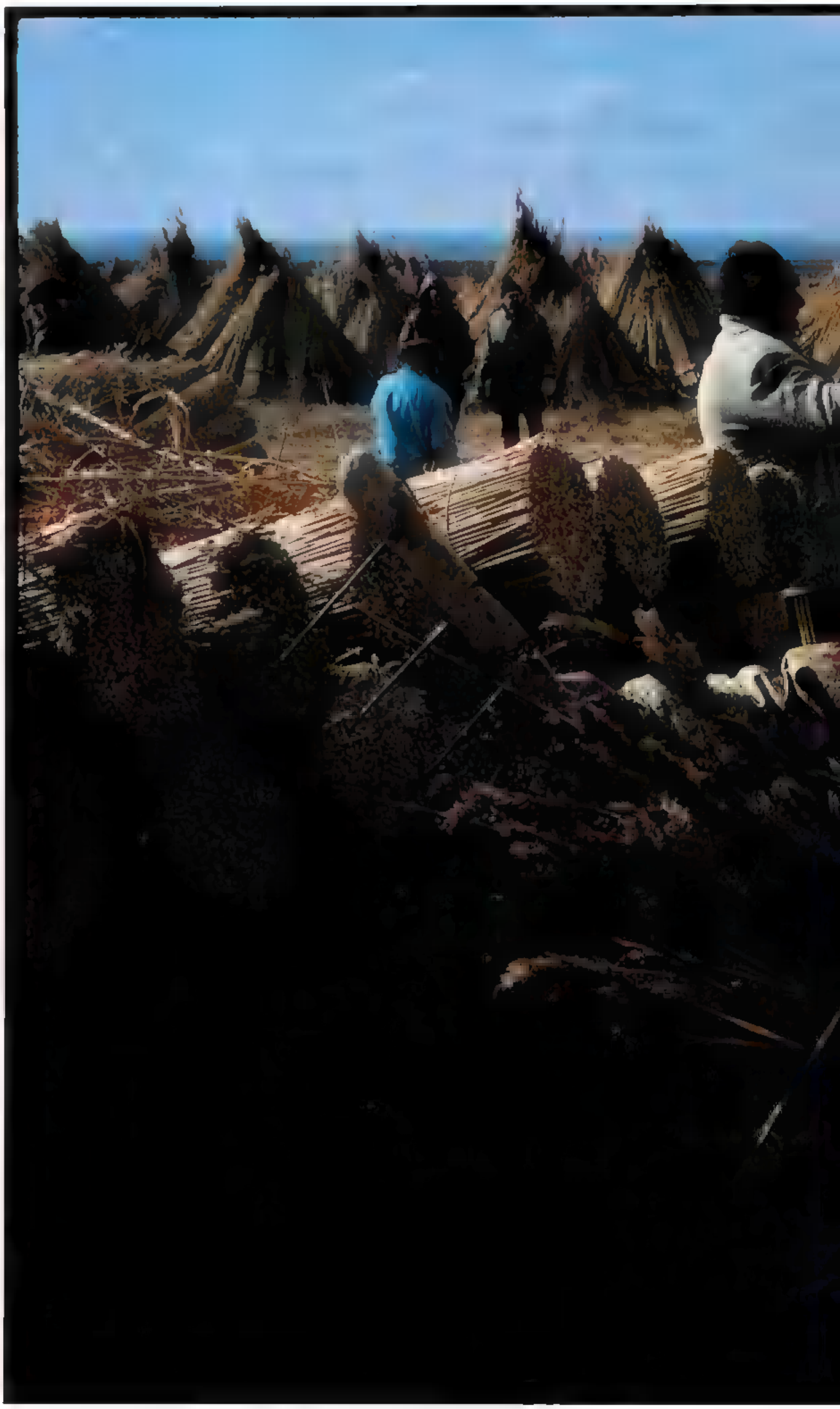
Water World

GRAVITY AND GLEE

Devotion finds expression through a paintbrush as parishioners spruce up St. Dumitru Ukrainian Orthodox Church in the village of Caraorman. Though predominantly Romanian, the delta's 15,000 or so residents also include a sizable community of Lipovans, descendants of settlers who fled Russia in the 18th century rather than accede to the dictums of Tsar Peter the Great, including a ban on wearing beards.

A woman prepares to water flowers in the cemetery at Sulina (below), a port located where the delta's main shipping channel meets the Black Sea. Reflecting the delta's historical religious diversity, the cemetery has sections for Christian, Muslim, and Jewish graves.

Spirits were high at a wedding reception in Crişan (above), where stuffed cabbages and homemade wine fueled dancing until dawn.



MARSH
BOUNTY

Workers harvest reeds for thatched roofs, mats, baskets, and pulp to make paper. The delta includes the world's largest expanse of reeds, parts of which separate and become floating islands. The plants filter the water and provide cover for birds and other wildlife. Rural delta residents, who live mainly in small villages of a few hundred people, also fish, raise crops, and tend cattle.

A HAVEN TO CHERISH

In loose formation, an avian squadron lifts off from Lake Roşca (top), home to Europe's largest great white pelican colony. The delta is an important stop for migratory flocks and provides habitat for more than 300 bird species, including swans and sea eagles. Bird-watching towers overlook many of the delta's calm byways (above).

Holding a tiny mirror, a tourist camper grooms himself at dawn (right) before a day of fishing with friends on holiday from Romania's Transylvania region.

Pollution threatens some fish populations; others have suffered from development projects of Romania's communist regime. Upriver dams affected valuable caviar-producing sturgeon, and a fifth of the delta was converted to fields and fishponds, a calamity now being reversed to restore this realm to its natural state. □

Tiffaning his scent and a new [illegible] on the Kilham [illegible] Squirty, one of 31 [illegible] black

MOTHER BEAR MAN

BEN KILHAM NURTURES CUBS BACK TO NATURE

hand he has returned to the wild using a radical technique beginning with mom

ARTICLE AND PHOTOGRAPHS BY ROBERT CAPUTO

"Watch this," Ben Kilham called out as we tromped through the New Hampshire woods one fine summer's day. Ben wandered off the path, hunted around for a few minutes, then got down on all fours. Almost immediately two black bear cubs came barreling out of the bushes toward him. Most people would be rather put off by this, but then few have the relationship with bears Ben does. He lowered his head and began chomping on Indian cucumber pushing up through the litter on the forest floor. The cubs stuck their noses in his mouth, took a good whiff, hunted around for the same plant, and then began eating it too.

"They've never eaten Indian cucumber before," Ben said. "They've walked right past it a hundred times without knowing it was food. Somebody had to teach them to eat it."

Because these cubs are orphans, that somebody was Ben. He has been working with orphaned, sick, and injured black bear cubs for nine years, and his unique way of rehabilitating them has led the folks around Lyme to call him the Bear Man.

Most of us do everything we can to avoid running into bears when we're in the woods. Not Ben. He may be two-legged and smell different, but to Yoda and Houdini, the two cubs, Ben is Mom. And they are his children.

Their special relationship started one cold day that March. John O'Brien, a local forester, was surveying the progress of a logging operation on Moose Mountain when he heard a strange noise.

"It was something I'd never heard before, kind of a cross between a hawk and a baby animal," John said later. "I worked my way into a thicket and got close enough to see two tiny cubs wrapped up in each other's arms on the lip of a den. I thought I'd better leave because mama must be around somewhere and ought to be coming back."

But when the cubs' mother still had not returned late in the day, John, worried about the approaching severe cold of night, called Ben.

"From the lack of tracks and the state of the cubs, it was obvious that Mom hadn't been around for several days," Ben explained. "The cubs were probably about nine weeks old but weighed less than four pounds each. They should have weighed six or seven. They were hugging each other, desperately trying to keep warm. I don't think they would have made it through another night. We had no choice but to take them."

Black bears are extremely good mothers, and only an imminent threat to their own lives will make them abandon their young. A logging crew had been working near the den for a week, clearing ice-damaged trees that would pose a fire hazard later in the year. Because of the snow and thick undergrowth the den was impossible to see, and a mechanical harvester had backed right up to it. The racket, diesel exhaust, and looming tires had probably made mama bear flee. The crew had never heard or seen a thing. If John hadn't walked nearby that day, the cubs would have frozen to death.

"It's impossible to say how many black bear cubs are orphaned in the United States," Ben said. "About 150 are found each year in 30 or so states."

Ben wrapped the cubs in a blanket and took them to his house, where he, his wife, and his

A HARD CLIMB

Six-month-old Houdini clings to a tree near Lyme, New Hampshire. Kilham's hands-on approach provides a rare window into bear behavior. "Young males are highly emotional creatures," says the gunsmith turned naturalist. "Their lives are not easy nor that long." Many are killed by humans or older bears as they move into new territory.

sister could look after them. The little bears devoured formula from baby bottles and then snuggled contentedly in a spare bedroom for much needed sleep.

The Kilham family house overlooks the picturesque green in the center of Lyme, and it's no stranger to orphaned animals. Ben's father taught microbiology and medical history at nearby Dartmouth College, and the family developed a passion for helping injured and orphaned animals.

"We had owls, red-tailed hawks, prairie falcons, ravens, crows, raccoons, ferrets, a fox. There were always animals wandering around the house," Ben told me. "We even had a young beaver that kept trying to dam up the toilet."

When Ben returned to his hometown in 1982 after a career with Colt and other gun manufacturers, he set up shop as a gunsmith. His family background, however, soon led him to take up animal rehabilitation. He obtained permits from the New Hampshire Fish and Game Department and worked with fishers, skunks, porcupines, raccoons, and in 1992 his first black bear, a sick yearling he named Wobbly.

"I didn't plan to study bears," Ben explained, "but working with Wobbly got me hooked. I'd always had the idea that the way to learn about animals was to start with a young one and watch it grow, that you would learn more that way than just by watching adults. Two things I didn't realize when I began were how little was known about black bear behavior and how much these little guys would teach me."

It surprised me too that so little is known about an animal with which we live in such proximity. We grow up with bears: Teddy bears keep us company in the crib; Smokey Bear warns us about fires; Winnie the Pooh and his countless cousins populate our bedtime stories.

WE MAY LOVE BEARS when we're children, but we haven't tolerated them very well as adults. *Ursus americanus* once roamed throughout North America, living in every habitat from the swamps of Louisiana and Florida to the chaparral of the Southwest and the dense forests of the Pacific Northwest. But European colonizers viewed bears as pests and hunted them mercilessly. In modern times the hunting continued, and bounties for killing bears were paid into the 1960s. The New Hampshire population dipped to below 500 in the 1940s, when there were only 175,000 black bears in all of North America.

EDUCATING LITTLE BEARS

Most [illegible] minimize human contact with their charges. Not Kilham. When a [illegible] brought him [illegible] sister Yoda, the frostbitten cubs [illegible] Kilham's guest room.

"The bond isn't that [illegible]," he says. "They do anything to [illegible] me into caring for them, even raking him with their claws. [illegible] on sheep's milk and [illegible] the cubs were moved to an enclosure [illegible] of town where their education [illegible]. The idea is to [illegible] in their own environment and [illegible] them to things [illegible] encounter in the wild, Kilham. Some [illegible] feared that such contact [illegible] create a high percentage [illegible] two of the 31 [illegible] known to become [illegible] feeders to [illegible]

But black bears are remarkably adaptable. Although licensed hunters kill 40,000 bears annually, they have made a comeback in the past 50 years. New Hampshire's population now accounts for about 5,000 of the 700,000 black bears living in 32 states, Canada, and Mexico.

As the number of bears increases and human settlement pushes farther into their habitat, encounters between bears and people become more common. The number of incidents on woodland trails and at bird feeders and garbage cans grows. And our ambivalent attitude persists: We like seeing bears in the woods, but we don't like it when they want to come into the house.

Our fears, however, are unwarranted: Since 1900, 43 people have been killed by black bears in North America (a person is far more likely to be struck by lightning). As with most wild animals, our fear is a result of ignorance.

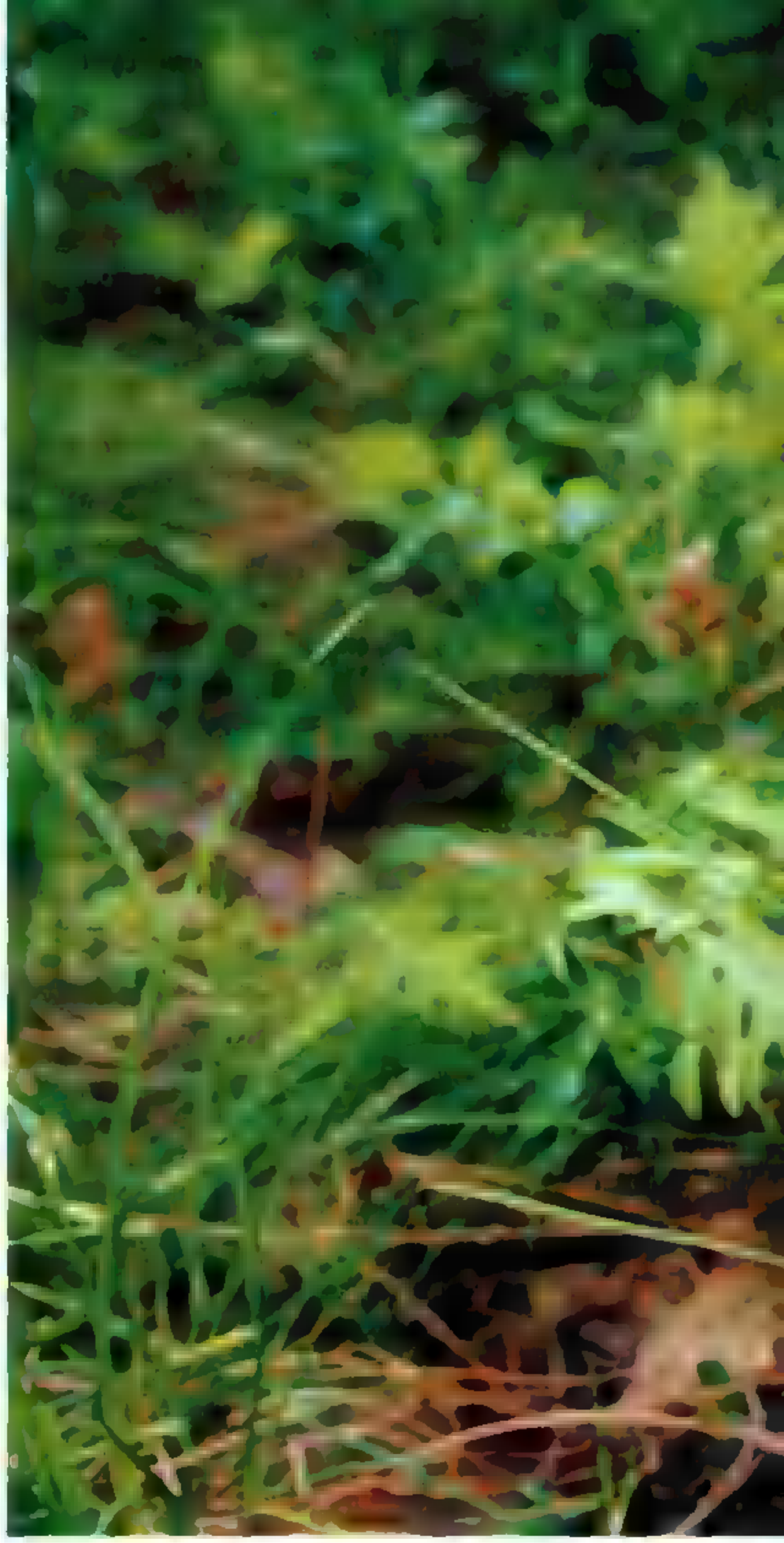
"We know more about the behavior of the lions, wildebeests, and elephants on the Serengeti Plain than we do about the bears that live in our backyards," Ben said. "When I got interested in bears, I read everything I could get my hands on. There wasn't much. There were population and range studies but almost nothing on behavior. I couldn't believe it."

Ben was also intrigued that many orphan bears didn't fare very well after they had been raised and released into the wild. They often died or became nuisances with a penchant for showing up where they were not welcome.

"The usual way to raise orphans is to minimize contact—put a tarp over their cage so they can't see people stick food in through a hole. The idea is that they won't get used to people feeding them. It's ironic, though, because bears know the world primarily through smell, and they know very well who's on the other side of the tarp. The bears are kept in enclosures for 18 months, then released into a world they know nothing about."

Ben tried a different approach. He learned from Wobbly and subsequent cubs he raised that bears are sensitive, intelligent, and emotional creatures that need more than food. They need security, affection, and someone to teach them.

At first Ben kept Yoda, a gentle female, and Houdini, a male with a penchant for escaping, in his house, encouraging them to play with him and each other. The cubs soon came to treat Ben just as they would their mother—crawling into his lap to nurse, suckling his fingers and ears as signs of affection, and



FINDING BEAR FOOD

Imitating mama bear, Kilham chews Indian cucumber, showing Houdini that it's edible, while Yoda play-wrestles from behind. After watching the cubs forage, Kilham discovered what he believes is an organ in bears' mouths loaded with chemoreceptors that help them identify safe foods. Flowering plants are early favorites, especially those that produce berries later on, such as purple avens (right).

climbing over him in play. Scars on Ben's face and hands attest to the keenness of their claws.

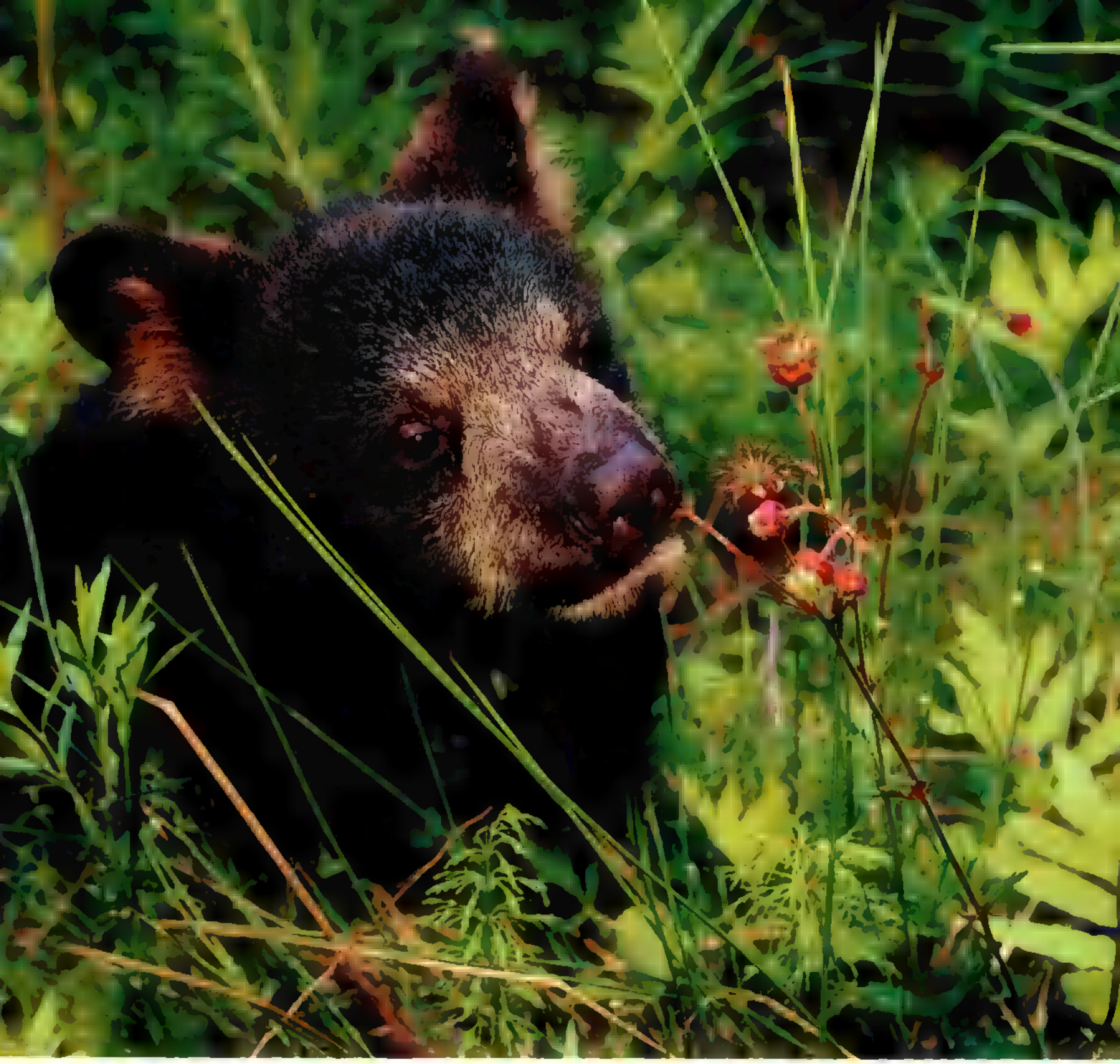
But a house is not a good place to keep growing bears. When the weather warmed and the cubs had recovered their weight and strength, Ben took them to a large pen he'd built in the woods outside town.

Watching Ben prepare the pen for the cubs' arrival was like watching a mother prepare a nursery for a newborn baby. He made sure the wire walls were strong enough to keep the cubs from wandering off and coyotes or other predators from getting in. He dragged big logs into the pen for climbing, layered a wooden box with straw for sleeping on, set out pails of water, and even brought toys.

Twice a day Ben visited the cubs with baby bottles full of formula and apple juice. This invariably sent the cubs into a frenzy as they clawed their way into his lap and settled down to nurse. As they got older, Ben supplemented the bottles with dry dog food. Yoda always picked out the hard red and brown bits; Houdini preferred the soft yellow and orange ones. Once the cubs were full, Ben took them for long walks in the woods.

"Any animal with a long dependency—18 months for these bears—probably has a lot to learn," Ben said as we walked with the cubs. "The only way they can do that is by being out here in the woods."

The success of Ben's technique was obvious. The cubs had been trailing behind us, occasionally stopping to sniff the ground or bushes. When we sat down, the cubs took to the woods, chasing each other, tearing apart rotting logs



to look for ants and grubs, scampering up trees. They never strayed too far from us, but Ben's presence seemed to give them the security they needed to set off, tentatively, on their own.

"Every time I come out here with the bears, I learn something just by watching them," Ben said. "I've noticed, for example, that the cubs hold plants in their mouths before they eat or discard them. My theory is that bears have chemoreceptors that analyze the plants and let the animals know if they're edible. And when they first come out of hibernation, they search diligently for moose and deer scat to eat. They seem to need the bacteria to get their digestive systems going again. If you don't know this, you can feed them all you want, but it's not going to do much good."

THE REAL TEST of Ben's rehabilitation method, though, isn't how healthy his cubs are or how freely they romp in the woods. It's what kind of adults they will turn out to be. Can they survive as wild bears?

"A lot of other rehabilitators thought my cubs would become nuisance bears that wouldn't be afraid of people and in fact would seek them out for food. But bears are smarter than that. It's not people they've gotten to know; it's me as an individual."

To prove his point, Ben took me to visit Squirty, a three-year-old female living in the woods outside Lyme. Squirty, along with her brother and sister, had been orphaned, and Ben had raised them in much the same way as Yoda and Houdini. Now grown up, with two cubs of her own, she was thriving in the wild.

Houdini, [illegible] and Yoda, [illegible] into [illegible] ten-month-old [illegible] a [illegible]


tree, which during breeding season you as the page for hours in the

We drove several miles from Lyme, got on three-wheelers to negotiate a logging road, then hiked about a mile into the woods. Along the way Ben pointed out what he called bear trees.

"This is one of the many things I've learned from Squirty and her siblings," Ben said. "Trees like this red pine are the equivalent of bear bulletin boards. If we had a bear's sense of smell, we would know which bears have been here and when. If the bears are passing through, they might just brush against a bush, and the scent would last 48 hours or so. But if they want to leave a message, they bite or do a full back rub on one of these bear trees. The porous bark holds the scent for a long time. Look, you can see the hairs left in the bark."

Primarily olfactory animals, bears communicate with each other by leaving scent deposits. Females advertise their reproductive state and receptivity; males announce to females that they're around and warn smaller males to stay out of the way. Ben's observations reveal that bears may even leave messages about the availability of food. Scientists and other observers have also reported seeing bears rub on trees, but because Ben's bears tolerate his presence so calmly, he has been able to decipher more of their behavior.

"Watching bears in the wild is extremely difficult unless you have a relationship with them," Ben explained. "Wild bears become very nervous when people are around, so you're not likely to see much natural behavior. My guys ignore me and go on about their business."

Ben paused to check the signal from Squirty's radio collar. "Come on. She's just up here."

CLOSE ENCOUNTERS

Bonding comes quickly with orphaned cubs, but Squirty's wild brood waits seven months before trusting Kilham's touch. "They've got to work out their own relationship with me," he says. Despite her upbringing, Squirty's tolerance does not extend to other humans. She rises (left) to inspect author Robert Caputo, whom she allowed nearby only as long it took to eat a snack—about 30 minutes.

Approaching cute little cubs is one thing; walking up to a fully grown wild mother bear with cubs to protect is quite another. As we neared, Ben called out to let Squirty know who was coming. I heard a rapid whooshing sound as she warned her cubs, followed by the scrape of little claws scampering up a tree to safety. I followed Ben as he walked toward Squirty.

"You'd better stay here," Ben said as we drew close. I was happy to oblige.

Squirty eyed me suspiciously as she walked up to greet Ben, whom she still seems to regard as her mother. The two cubs peered down nervously from their perch. Ben sat down next to Squirty and stroked her neck, saying softly, "He's all right, Squirty. He's with me. It's OK."

Squirty, however, wasn't so sure. She walked slowly toward me, her head down and teeth chomping. I looked at Ben. "Hold still," he said.

When she was about 15 feet away, Squirty lunged at me and made a deep grumbling sound. Then she did it again. I had just enough of my wits about me to know I could never outrun a bear, but it was hard to heed Ben's advice with 200 pounds of angry bear charging at me. Shaking slightly, I slowly backed up several feet. That seemed to be what Squirty wanted; I had been too close. She turned, went back to Ben, and snuggled into his lap.

The cubs, seeing that mom was comfortable with Ben, soon climbed down and joined the pile. Squirty kept half an eye on me to make sure I didn't try to edge closer, but otherwise she appeared relaxed. I didn't need any further proof that she could distinguish between Ben and other human beings.

A BEAR ON HIS OWN

Kilham can't mimic a mother bear's fierce protection. Chased off early by sister Yoda's suitors, Houdini, above, was killed at a bird feeder. Yoda still thrives in the wild world of black bears.

Ben gave Squirty some dry dog food to supplement her diet while she was nursing. For the most part, though, she was fending for herself.

"There are houses with bird feeders and garbage cans all around here," Ben said. "Squirty's been living on her own for two years, but she has never been near any of them. I don't think being raised by a surrogate mother has had any ill effects on her at all."

I RETURNED to New Hampshire several times over the next year. Yoda and Houdini grew rapidly and became more independent. When Ben had first taken them into the woods, they had followed him closely. By late fall they were leading the way and even disappearing for days at a time. They were fat balls of shiny fur; Houdini must have weighed a hundred pounds. That winter, which the cubs would have spent denning with their mother, Ben built a warm, cozy den for them, and he was there when they emerged in the spring.

By the following summer Yoda had established a territory near their den—females stay close to where they are raised—while Houdini had begun ranging far and wide, as orphaned males must. Life was hard for him. He wasn't old enough to mate, and his wandering made

him vulnerable to hunters and other bears —and led him into more populated areas. One day last spring, after being attacked by an older male, Houdini fled to a development where he had been fed before. This time he paid a high price for an easy meal: He was shot as he raided a bird feeder.

Houdini was only the second bear known to have been killed of the 31 that Ben has raised. For most of his bears adaptation to the wild has come naturally, and Ben has continued to learn from them. He was able to watch how Squirty raised her cubs and apply what he learned to his care of Yoda and Houdini. They, in turn, taught Ben things that will make him an even better mom for the next orphans that will come his way.

Although Ben's methods are unconventional, a number of biologists have come to admire his work. "I learned more about black bears in six hours with Ben and his bears than in the past 20 years," said Eric Orff, a bear expert and senior wildlife biologist with the New Hampshire Fish and Game Department.

"I help the cubs, and they teach me," Ben said on my last trip as we watched Yoda disappear into the woods. "I've learned a lot about bears that was previously unknown, simply because they accept me. I hope what I learn will help us understand and protect them.

"But most of all," he said as Yoda turned to look back at us, "I just like being out here with them." □

MORE ON OUR WEBSITE

Watch a video of Ben Kilham teaching black bear cubs how to survive in the wild at **nationalgeographic.com/ngm/0203**.

An Extraordinary Shipwreck

GOLDEN AGE

IN THE WATERS off the coast of Israel, a modern submersible gives researchers a first-hand view of an ancient shipwreck — the last ship from Greece's Golden Age to be found and excavated. Archaeologists have returned with an array of well-preserved artifacts, providing a revealing picture of Greek civilization at its cultural zenith.

From the Time of Socrates Reveals . . .

TREASURES

TRUSTEES © BRITISH MUSEUM, LONDON

HYPNOTIC SONGS OF THE SIRENS lure [illegible] toward [illegible] rocks in [illegible] wax ears [illegible] crew, who [illegible] tied him [illegible] mast so he could [illegible] sirens [illegible] recover artifacts, [illegible] did not [illegible]

"Do you think men [illegible] ever hear what happened [illegible]? Do you think anyone ever [illegible]?"

Jon [illegible] posed these questions while he and I hovered in [illegible] just above the remnants of a small merchant ship that sank more than 2,400 years ago. "There were no radios then," he continued. "No distress rescues. Who would have [illegible]?"

Encircled in our acrylic cocoon in the Turkish Aegean, archaeologist Elizabeth Greene carried an amphora, or two-handled jar, to a lift bas-ket and placed it inside. Like a lumpy brown glacier, a ridge of corals [illegible] surrounded 20 feet up a rocky gully behind [illegible]. Another amphora jar

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By [illegible]

Photographs by [illegible]

LAST STOP FOR A SHORT HAULER

GREECE'S [illegible] during its Golden Age [illegible] in Athens, where [illegible] Pericles, [illegible] Socrates, and dramatists [illegible] and [illegible] center [illegible]. Yet the maritime [illegible] helped make this [illegible] largely [illegible] in the [illegible] now. What [illegible] amount of [illegible] the vessel was of modest [illegible] of the [illegible] to think most were made not far [illegible] wreck site, [illegible] well-traveled [illegible] routes [illegible] the wreck? [illegible] The vessel's wooden hull [illegible] but [illegible] outline can still [illegible] seen [illegible]

ART BY DONALD DEMERS [illegible] WRECK MAP BY GLASGOW MEDIA; MODELING BY [illegible] MATTHEWS WITH RHINOCEROS

vacuumed sediment from the site by fanning sand into the mouth of a nearly vertical suction pipe. Farther away two divers took careful measurements with meter tapes and recorded the data with pencils on plastic slates, while another broke away concretion, the thick layer of cement-like calcareous deposits that build up on objects lying on the seabed. They worked quickly, efficiently, for at this depth each diver had only 20 minutes to complete the morning's assigned task.

SOCIETY GRANT

This Research Committee project is supported by your Society membership.

In four decades of diving with scuba gear on shipwrecks, I'd been too busy carrying out similar tasks—measuring, recording, excavating, and raising artifacts—to be thinking of the mothers, wives, and children whose loved ones may have disappeared long ago, their cries for help unheard.*

Now, in the summer of 2000, it took Jon, who is not an archaeologist, to distract me from the technical aspects of my trade. He piloted the two-person submersible *Carolyn*, giving us the luxury of spending hours on this site as observers and giving him the chance to ask me questions about the wreck.

But this was not just any wreck. Four years earlier Tufan Turanlı had called me at the Institute of Nautical Archaeology, or INA, based at Texas A&M University. Tufan was on board INA's research ship, *Virazon*, directing divers in our annual underwater survey along the Turkish coast.

"We've found a wreck from the fifth century B.C.," he reported. "It's about 140 feet deep, with several dozen beautiful amphoras visible in the sand." He recalls, still voicing surprise, that only ten minutes into the conversation I interrupted: "I've heard enough. That'll be the next wreck INA excavates."

Although I've uncovered the remains of ships from the Bronze Age to medieval times, and although INA has located more than a hundred ancient shipwrecks along the Turkish coast, I had never even seen a wreck of the fifth century B.C. INA was already excavating a Byzantine shipwreck off Turkey's coast, so it was not until 1999 that we could begin the three-year excavation of Tufan's discovery.

In the meantime the wreck took on even greater importance. From photographs of the cargo, Mark Lawall, an amphora expert at the University of Manitoba, dated our wreck

*See "Oldest Known Shipwreck Reveals Splendors of the Bronze Age," by George F. Bass, NATIONAL GEOGRAPHIC, December 1987.

PICTURING WHAT'S WHERE

TO DEVELOP A VIVID PICTURE of the ship's remains, divers with video cameras documented the layout of the wreck (below). Such data, combined with detailed digital renderings of each recovered artifact (right), produced a 3-D portrait of the site, providing researchers with powerful new perspectives. "I'm addicted," says Xila Matthews, diva of the

project's digital domain. "This computer system gives us accuracy and speed and makes it much easier to identify distribution patterns of artifacts on the shipwreck." Her computer lab was perched on the rocky shore alongside dorms, bathhouses, and a mess hall for the 30-plus members of the excavation team.

to the third quarter of the fifth century B.C., during the Golden Age of classical Greece.

WAS EVER THERE a time in human history when architecture, philosophy, sculpture, drama, and politics reached near perfection in so few years? Under the inspired political leadership of Pericles, Athens controlled an empire that stretched from one side of the Aegean to the other. In Athens, Phidias was supervising sculptors who carved the friezes of the Parthenon. Another great artist, Polyclitus, imparted ideal proportions for the human body in his statues of athletes, while dramatists like Euripides and Sophocles vied for prizes, the Tony Awards of the time—a time recorded by Herodotus, the father of history, and Thucydides, the better historian. And all the while Socrates annoyed the public by asking people if they really knew what they were talking about.

But none of this could have happened without ships. Athens could not even feed her people without the grain brought from abroad by sea. The strength and prosperity of the Athenian empire, initially formed as a defense against the Persians, were based on naval might and maritime commerce. The policies of Pericles fostered not only the arts but commercial enterprises as well.

Now, from inside the submersible, Jon and I were looking at the remains of one of the very vessels that made Greece's greatness possible, a wreck whose date Mark Lawall would later narrow down to between 440 and 425 B.C.

With delicate movements of the joystick Jon maneuvered *Carolyn* away from the wreck, out of the jungle of cables, hoses, pipes, and lines, and back up to the surface near Tektaş Burnu.

Tektaş Burnu, the Cape of the Single Rock, lies on Turkey's Aegean coast not far south of the resort town of Çeşme. Tektaş itself, the single rock, rises from the sea near the cape.

Haze prevented Jon and me from seeing the Greek islands of Samos to the south and Chios to the north, but they are usually clearly visible from the cape. Both were part of the Athenian empire. In 440 B.C. Pericles sailed to Samos with 60 ships to put down a rebellion. He sent one of his companions, the dramatist and general Sophocles, to Chios on a diplomatic mission that helped end the rebellion the following year.

Had the mariners on the doomed ship Jon and I just left seen either man? They sailed the

POTTERY REVEALS PART OF THE PAST

BRUSHING AWAY sediment, chief conservator Asaf Oron works with a delicate hand (far right) to ensure that artifacts surface unscathed. Among the most intriguing was a collection of tableware that included an oil lamp and a pair of one-handled cups (above) and a pitcher called an *askos* (right). Why do scholars get excited by such finds? Artifacts help identify ancient trade routes, which bring key details of a distant world into sharper focus, says Mark Lawall, a classics professor at the University of Manitoba. "Imports, exports, the impact of war on commerce—these were not topics of concern to the great dramatists, historians, and philosophers of ancient Greece." Pottery, then, answers questions Socrates never bothered to ask.


OCEANIC

same route. For the first time on any of my underwater digs, I felt that I was almost rubbing shoulders with ancient celebrities.

Jon steered *Carolyn* up a ramp between the pontoons of our 45-foot steel catamaran, which was anchored in a cove, and within seconds we were winched up to deck level. After pushing back the hinged top half of the clear acrylic sphere and stepping out, we went by small boat to the expedition camp on shore.

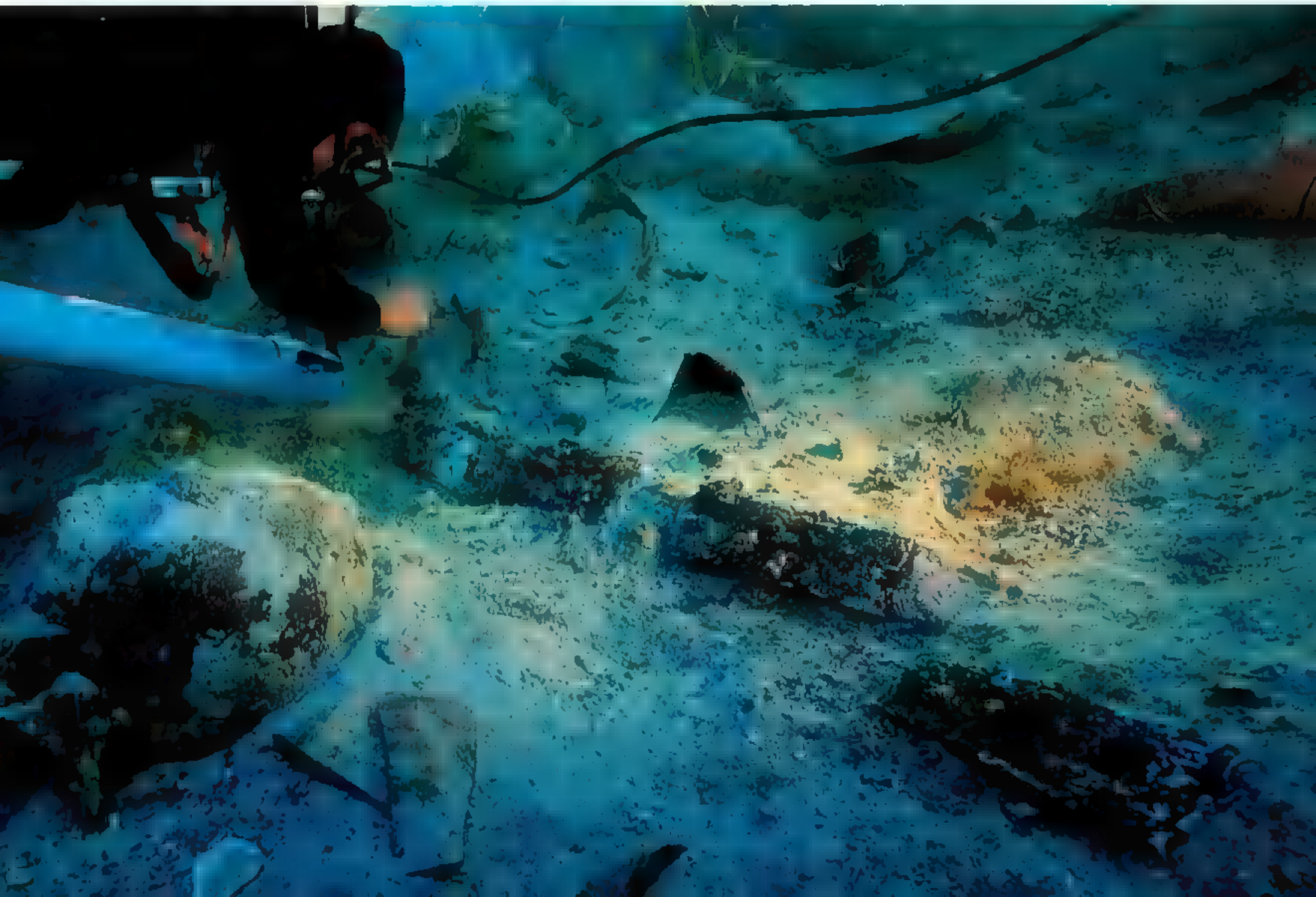
Our home for months at a time, the camp is now a comfortable village, but it was built with grit and sweat. The cape has been washed into jagged teeth of solid rock by countless millennia of winter waves. When I clambered onto those terrible fangs in 1999 looking for a place to build a summer home for upwards of 30 people, I could never let go with my hands as I stepped gingerly from one sharp spike to the next. But the long-term advantage of quartering as close as possible to the wreck site outweighed the short-term disadvantage of having to spend two months transforming the rock into a suitable camp. During the construction period many of us resembled convicts breaking rock on some Devil's Island, and our archaeology students had to develop new skills—as plumbers, electricians, and master carpenters. We slept offshore in cramped and airless quarters on a chartered wooden minesweeper launched in 1942.

Our team was an international group—from the United States, Turkey, Spain, Bulgaria, Australia, Israel, Canada, and the United Kingdom—brought together with support from the National Geographic Society, the National Endowment for the Humanities, the University of South Florida, and Turkish Airlines. We were mostly archaeologists, classicists, historians, and students, but the team was rounded out by several conservators, mechanics, a physician, and a cook.

EARLY THAT FIRST SUMMER assistant excavation director Deborah Carlson surfaced from a dive with news of an exciting find: "It's a hydria. I'm sure of it," she said. "I could feel the vertical handle under the concretion." In such a comment lies the thrill of archaeology.

Classical Greek ceramics, unlike Oriental pottery with its myriad shapes, were extremely conservative, comprising a few dozen shapes that changed little over the centuries. Most had to do with the custom of drinking wine.

There were the large, two-handled amphorae (from the Greek *amphi*, "on both sides," and



phero, "to carry") in which wine was transported and the smaller, flat-bottomed amphorae to hold wine at the table. Greeks thought that terrible things—blindness or insanity—resulted from drinking undiluted wine. They always mixed it with water. And they brought water from the well or fountain house in a round jar called a hydria, with two horizontal handles for lifting and one vertical handle for pouring. They mixed the wine and water in a large bowl—a krater—much like a modern punch bowl. From the krater the diluted wine was dipped with a ladle, usually of metal, and decanted into a pitcher. Lastly the wine was poured from the pitcher into a one- or two-handled drinking cup.

We excavated examples of nearly every shape, most in such multiples that we assume they were cargo rather than tableware for the crew. Almost all seem to have been manufactured on Chios, close to where they went to the sea bottom.

I stopped diving regularly in 1984, turning over the bulk of the underwater work to a younger generation, but I continue to make inspection dives on most wrecks we excavate. On the day of my first dive on the wreck in 1999, Sam Lin, a new Texas A&M graduate student, and INA veteran Faith Hentschel uncovered in the upper area of the sloping seabed a marble disk about six inches in diameter. Other team members guessed that it was one of the ship's two *ophthalmoi*, or eyes.

Eyes to give life to a ship or to help it see its way through the waves are common to many cultures from Portugal to India. It has long been known from Greek vase paintings that classical ships had such eyes. Those on merchant vessels were sometimes depicted as simple circles, like the one we found, on either side of the hull near the prow. Although naturalistic marble eyes had been excavated in the remains of sheds that once housed the famed Greek warships called triremes, most scholars assumed that the eyes on the bows of more modest merchantmen were simply painted on. Our marble eye, the first from an ancient wreck and the first associated with a merchant ship, suggests otherwise.

When we studied the marble eye more carefully, we saw how it had been painted black with a pupil and an outer ring to delineate the iris, then fastened to the hull with a lead spike. At summer's end I accompanied Deborah and others of our team to the Archaeological Museum of Piraeus, the port of Athens, to examine trireme eyes excavated in the ship sheds there. We found their centers to be identical to

RECOVERING RARE ANCHORS

DIVERS HOISTED lead cores from five remarkable anchor stocks—crossbars that help drive an anchor into the seabed. Prior to this era most stocks were cut stone; these were wooden with lead cores, the earliest ever found. Two stocks had four short pieces (left); three stocks were made with two larger lead cores (below). The anchors' wood rotted away ages ago, but an artist's rendering (right) shows the slots where craftsmen poured the molten lead.

ART BY ROBERT LA POINTE

our eye and were now certain that our original hunch was right: We had one of our ship's eyes.

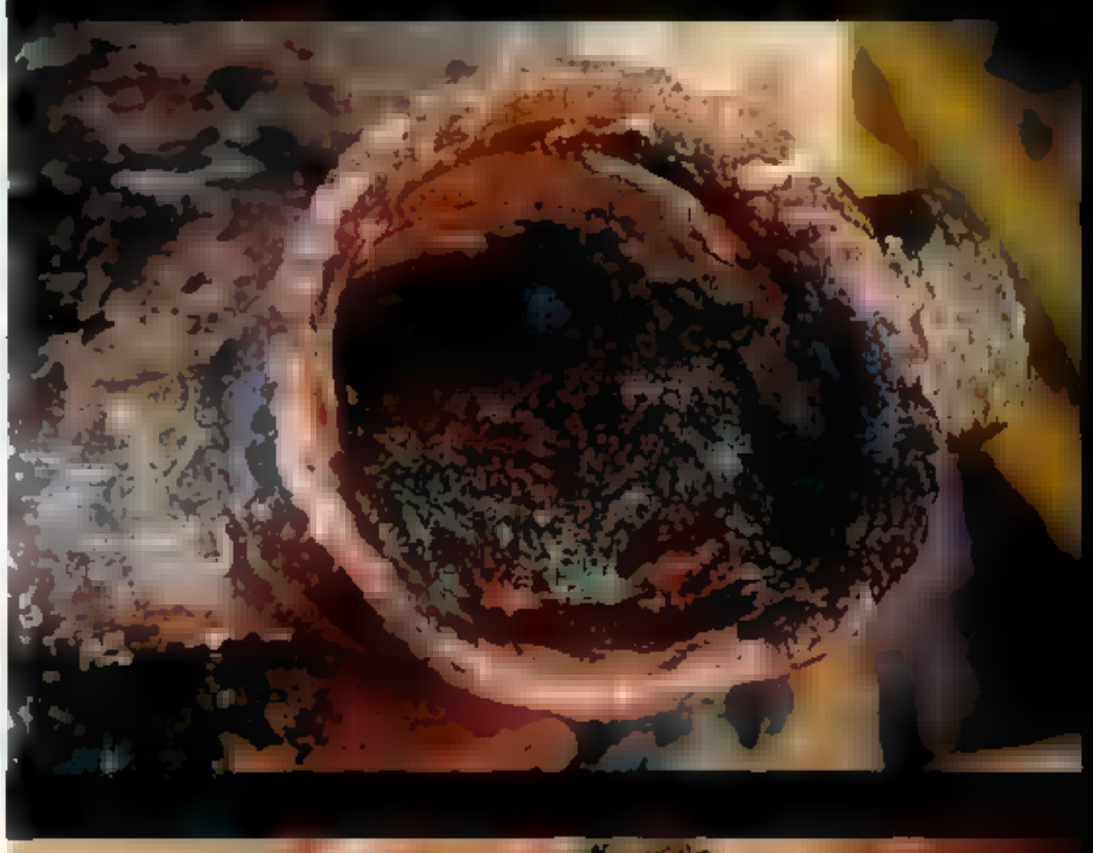
Did the sailors who depended on such an eye for safety survive its last voyage? Despite Jon Council's assumption that they had all gone down with the ship, it's quite possible that they would have lived through the actual sinking. I've often said that the ships I excavated were so close to shore—all, like this one, less than a hundred yards from land when they sank—that the sailors probably swam to safety. And scenes from Greek literature as vivid as those from *Titanic* describe passengers fighting for lifeboats. But proximity to land and having lifeboats are no guarantees of safety: My own great-great-grandfather perished in the wreck of the *Atlantic*, the finest Long Island Sound steamer afloat, when she struck rocks and broke into pieces only 80 feet from shore during a Thanksgiving Day storm in 1846.

But even if some sailors on our wreck did swim to shore, it's hard to imagine that many managed to crawl up on Tektaş Burnu's exposed and jagged rocks while being smashed by waves like those that almost surely sank their ship. When we moved to our newly completed camp in August 1999 and began to dive from a wooden platform that jutted out high over the sea, the waves so battered us that we could scarcely haul ourselves up a solidly anchored diving ladder. Without it we could never have made it onto land.

In spite of the heavy seas we continued to make finds. Dive master Ken Trethewey, then a doctoral candidate in classics at Princeton and like Deborah and Elizabeth a product of the Texas A&M Nautical Archaeology Program, uncovered two rectangular lead bars, each about a foot and a half long. He recognized them as lead cores from a wooden anchor stock, the crosspiece that prevents an anchor from simply sliding along the seabed. Attached at right angles to the anchor's arms, it forces the fluke to dig in and hold. The earliest anchor stocks were of stone. Then someone had the idea of making them of heavier lead, which was poured while molten into carved wooden cases. Our stock proved to be the

CLUES FROM CLAY POTS

MORE THAN 2,400 YEARS on the [illegible] an amphora rises in a protective [illegible] under the watchful eye of Deborah Carlson, the project's [illegible]. On shore, team members sieve sediments that had settled inside clay pots (above). Many of the [illegible] recovered by the team contained organic remains—including pine tar (below), cattle [illegible], and other perishables that rarely survive at land sites.




DIVE BELOW

earliest example to incorporate lead, an innovation that became common throughout later Greek and early Roman times.

A single copper nail provided another milestone for nautical history. The nail's size and clenched shape gave us evidence that an internal frame had been nailed to the wooden hull, which was held together with pegged mortise-and-tenon joints. This was the earliest documented use of a design that was standard in later Greek and Roman ship construction. Rocky outcrops had prevented the hull from settling into the protective sand of the seabed, so we found almost no traces of the actual wood, which had long ago been devoured by shipworms and other marine borers.

Not all our discoveries were made underwater. In our field conservation laboratory at Tektaş Burnu the silt from each amphora was sieved and swirled in a bucket of water to float organic remains to the surface. One amphora, probably of local origin, contained butchered cattle ribs, almost certainly remnants of the "salt and ribs of beef" listed in antiquity as shipped from northeast Greece.

Excavation entails the physical destruction of a site, which can be studied, interpreted, and reinterpreted for years to come only by detailed plans and records made as excavation progresses. Before removal from the seabed, all our finds were mapped by means of a new computer program that quickly turned digital photographs taken from different points on the wreck into a highly accurate three-dimensional site plan.

In mid-September 1999 we ended our first excavation campaign and departed the Cape of the Single Rock, leaving most of the camp standing. To protect our two electric generators, weighing a ton and a half apiece, we dragged them 30 feet inland and 25 feet above sea level. It took six men just to lift their metal covers. The first storm of winter plucked the generators from the rock like corks, tossing one into the sea. A local fisherman relayed the news to us, and we had to make a chilly salvage from 140 feet in January.

The experience reminded us that if our ancient mariners sailed in winter—and some sailors clearly did, based on recently discovered fifth-century B.C. documents—they braved conditions that were far

WITH EYES OF STONE, A CLEARER VIEW

more treacherous than the storms we endured while diving during the summer.

WE RETURNED in June 2000 with a new fleet, including our submersible, *Carolyn*. The two occupants sit inside the acrylic sphere, able to see even downward between their feet. The controls are as simple as a computer game's joystick. It was a treat to take nondiving archaeologists, Turkish officials, project patrons, and local villagers to the site, allowing them to watch the excavation in progress from only a few feet away.

The submersible also allowed Deborah Carlson and me to take turns observing the work in progress for hours at a time rather than only during twice-daily 20-minute dives. Dives were limited to 20 minutes both for safety and efficiency. Diving for longer periods at this depth would require us to decompress for a long time—even on pure oxygen—to avoid the divers' sickness known as the bends.

By the end of the summer of 2000 we had found the ship's second marble eye and raised all the amphorae. In addition to over 200 probably made somewhere along the coast where we were diving, we had two from Chios and ten from Mende, a city in northeast Greece. One of the local amphorae, as well as one from Mende, contained cattle ribs, but the other nine from Mende were transporting a kind of pine tar used in antiquity for purposes as varied as caulking wooden ships and flavoring wine. It was not a rich cargo, perhaps explaining the lack of tools, weights, coins, and personal possessions we usually find on ancient wrecks. Perhaps the ship made only day trips between Chios and either Teos or Samos to the south, never far from home.

Last summer we completed the excavation, vacuuming the sand down to bedrock. Now several years of conservation, laboratory analysis, and library research will make sense of what we have found. Already we are getting the picture of a modest merchant who had probably borrowed money at between 20 percent and 30 percent interest to purchase the cargo that was later lost at Tektaş Burnu. The interest was staggeringly high because the moneylender would have to absorb all losses. But at least he, unlike the sailors aboard, had not risked—and perhaps lost—his life. ▯

MORE ON OUR WEBSITE

Get a behind-the-scenes look at an archaeological field camp ■ **nationalgeographic.com/ngm/0203.**
AOL Keyword: NatGeoMag

TRANSLUCENT FLASK made of alabaster (far left) may have contained perfume or scented oil—or may have been shipped empty as a luxury item for trade. Another key discovery: two marble *ophthalmoi*, the decorative "eyes" that mariners in antiquity affixed to the bows of their boats to help guide them across the sea. Archaeologists have long known that Greek warships were adorned with these eyes of marble, but until now they had never found a merchant shipwreck similarly detailed. Going down to retrieve one ophthalmos, author and project director George Bass (right) considers the discovery among the excavation's most memorable moments. "It brought the ship's crew alive for me," he says. "I recently saw a Turkish truck with eyes painted on each side of the bumper. The captain or builder of this ancient ship was a guy just like that truck driver."

Zip USA

MURFREESBORO, ARKANSAS

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DIAM

IS TOO
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Finders Keepers

CTABLES

LOCAL

ONDS

A sign touts souvenirs from the early Diamond Mough to the world open in the general public. For five dollars a day, pros hunters and tourists get a chance to search a gem.

JOHN L. BALCH

CRATER OF DIAMONDS STATE PARK

Soon after the 1906 discovery of diamonds the gem field welcomed fee-paying treasure hunters (above). Later a landowner sold lots for a "diamond rush" town.

BY ANDREW COCKBURN PHOTOGRAPHS BY CARY WOLINSKY

Shirley Strawn vividly remembers the moment she found her diamond. She had been digging for 18 months, "never missing a day," and had just dumped another bucket of dirt hauled from the bottom of her 14-foot-deep, hand-dug pit into the sieve. "There it was, sitting on the screen."

Shirley has found a lot of diamonds in her time, but this was a big one—more than three carats. "I knew right away what it was. I snatched it up and held it tight in my fist." Too excited to speak, she ran, stumbling through the sucking mud, to her friend and mentor, James Archer, who was digging nearby. "Girl," he exclaimed when she opened her palm, "you've got a beaut." From that day on, Shirley was famous—at least in Murfreesboro, the Diamond City, in Pike County, Arkansas.

If it weren't for the diamonds, no one would call it a city. It would just be a little town in southwest Arkansas, where the population of 1,764 (although Mayor Thelma Simon harbors dark suspicions about census undercounting) commutes to work in nearby cities or raises chickens for Tyson's or logs the surrounding pine forests, devastated by the great ice storm of Christmas 2000. But once upon a time an eruption brought up a stream of molten rock from deep in the Earth. This rock was laced with diamonds, which lay undisturbed in an eroding crater for tens of *millions of years until* one August afternoon almost a century ago, when a local farmer panning for gold in his field plucked two glittering crystals from the dirt.

Soon after, a full-scale commercial diamond mine was up and running—though not profitably enough to rebuild after a 1919 fire. Mismanagement and lawsuits quickly withered subsequent ventures, the last one in 1949. Finally, in 1972, the state inaugurated the 887-acre Crater of Diamonds State Park, which incorporated the mine and

VISITORS TO DIAMOND FIELD: 55,000 a year
GEMS FOUND: 600 a year
BEST QUALITY GEM EVER FOUND: 3.03-carat flawless diamond unearthed in 1990 and sold cut for $34,700
LARGEST EVER: "Uncle Sam," mined in 1924—40.23 carats rough and 12.42 carats cut
AVERAGE SIZE: One-fifth of a carat
SUCCESSFUL ATTEMPTS AT MINING DIAMONDS COMMERCIALLY: 0

opened the gates to visitors from far and wide, lured by diamond dreams.

Signs of the actual crater are long gone, but anyone can come and search in the park's 37-acre diamond field (plowed regularly for easier digging) and take away all the diamonds he might find. All you need is a shovel, a bucket, a sieve (all available for rent), and five dollars—paid at the entrance.

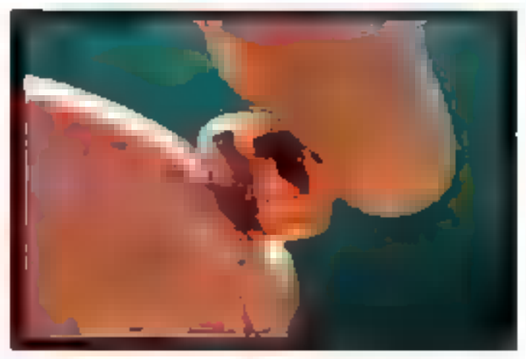
At 7:30 on a June morning, with the temperature in the high 70s and climbing, Shirley's friend James is waiting patiently at the park entrance for opening time. Tough as weathered whipcord, James, 76, the son of a sharecropper, has been coming here every day except Sunday for 30 years, working just as hard as he has since his father's heart attack turned him into the family provider at age ten. He says his diamond fever dates back to the moment when his wife, Gladys, came here for a day and found a diamond. "I said, 'I'm going to get me an itty-bitty diamond too,' but it was two years before I found a single one."

That was at least 5,000 diamonds ago. They have not made James rich, but they have earned him what he figures is gas money for the daily 30-mile round-trip from home. Most of the rough stones weigh only a fraction of a carat, and he ends up selling them to local people and rock shops for a modest price.

James's diamonds have also earned him an unofficial role at the mine. He's promoted to 55,000 visitors a year as the "living legend" who knows the "secrets of the crater." As he and I talked that morning, he gestured with amused cynicism to one regular, a daily digger like himself, loitering impatiently nearby. "He's just waiting to see where I'm going to dig today."

Shirley herself came from a logging family: "They all worked in the woods. When it rained, everybody was broke." But she grew up more interested in diamonds than in lumber, and she was always drawn to the mine. Even after finding that special diamond, Shirley kept digging, filling up her sample boxes with

"It was two years before I found a single one."



Even the darkest Murfreesboro diamonds (above) glimmer with hope. Alabama oral surgeon James Russell hauls dirt hoping for a stone worthy of his fiancée. (No luck.) Local James Archer looks for glitter six days a week—and finds just enough gems to cover his digging expenses.

bright little stones. She kept the big stone in the bank, taking it out once to see it sparkle under the lights as she rolled it on the pool table at the Timbers, the congenial private club (unique in rigorously dry Pike County) where Highway 27 comes into town. Having the diamond in the pocket of her jeans that day gave her a "cozy feeling."

Finally, eight years after she found it, she sent her stone off to a New York cutting and polishing firm. It cost her $3,000 to have it transformed into a 1.09-carat round brilliant cut, certified D-flawless in clarity and color and cut. "That means it's perfect in every way, as rare as rare can be," explains Shirley, who christened it the Strawn-Wagner diamond, combining her married name with that of a revered relative who had worked at the mine in its commercial days.

"One in a Billion!" shouted the *Arkansas Democrat-Gazette* when news of the certification reached home. The town pulsed with rumors that an Arab sheikh might be offering $300,000—or maybe a million—for the treasure. But Shirley had other ideas. "That stone was born in the crater and it's going to stay in the crater," she proclaimed. Helped by private donors, the state came up with $34,700 to buy her diamond for Arkansas. So, set in a ring, it now sits in its own display case in the foyer at park headquarters.

Around Murfreesboro there are those who think Shirley passed up big money through misguided sentiment. "She found the most exquisite diamond ever, ever, *ever*, and she gave it away," says one neighbor.

But Shirley wasn't much concerned with those opinions. She used some of the money to buy a house in the woods up above Lake Greeson. She now works the graveyard shift at the E-Z Mart, 10 p.m. to 6 a.m., hoping for a promotion to manager, digging when she gets the time. "You've got to take the greed out of your heart," she counsels. "Then the mine will give you something." □

Faux pearls adorn Little Miss Diamond contestants in the Diamond Festival Pageant at Murfreesboro High. The town's genuine gems haven't [illegible] fortunes—cutting timber and raising chickens pay the bills—but they have given Murfreesboro plenty of dreams.

MORE INFORMATION

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Final Edit

DANUBE RIVER

Life Goes On

"It's a rare moment when you chance upon something that brings all the visual elements of a situation together so beautifully," says photographer Ed Kashi. After days of drab scenes in Novi Sad, Yugoslavia, "I ran toward this one like it was an oasis in the desert." Serbian sunbathers were relaxing across from what remains of the Freedom Bridge, felled by NATO bombs in 1999. The wrecked bridge still hinders navigation on the nearly 1,800-mile-long Danube, affecting boats both upriver and downriver from Novi Sad. And yet, said Kashi, "these people look like they could be in Miami Beach. It shows their great resilience under difficult circumstances."

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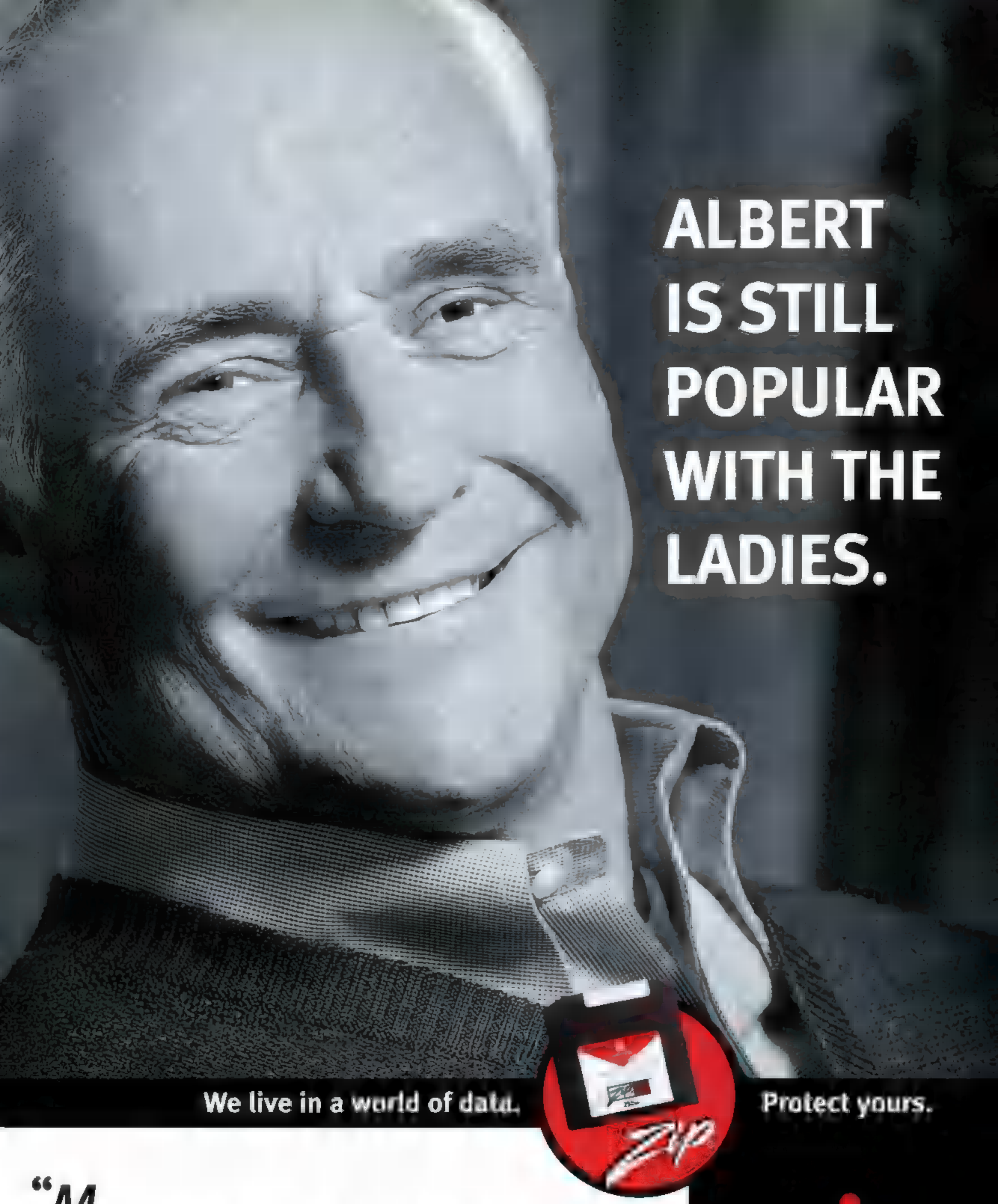

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That's what [illegible], a [illegible], did before his [illegible] that he [illegible] break [illegible] across [illegible] Arctic [illegible] from [illegible] home in Oslo, [illegible] skis [illegible] so that [illegible] Aware that [illegible] have [illegible] to [illegible] he [illegible] a [illegible] suit he dubbed "[illegible] Nemo," [illegible] its [illegible] inside his [illegible] makeshift skis. [illegible] was [illegible] of the [illegible] it takes to haul a [illegible] across [illegible] five or six [illegible] a [illegible] while [illegible] a [illegible] pack [illegible] "It's the same kind [illegible] effort," [illegible]

[illegible] fourth [illegible] to [illegible] "[illegible] is [illegible] last [illegible]" [illegible] Still, [illegible] out [illegible] "There [illegible] other [illegible] with [illegible] at other [illegible] far too [illegible] to [illegible]"

[illegible] STORVIK [illegible] AND BELOW), THOMAS ULRICH AND KRISTIJAN [illegible]

GNMENT

COVERING THE WORLD

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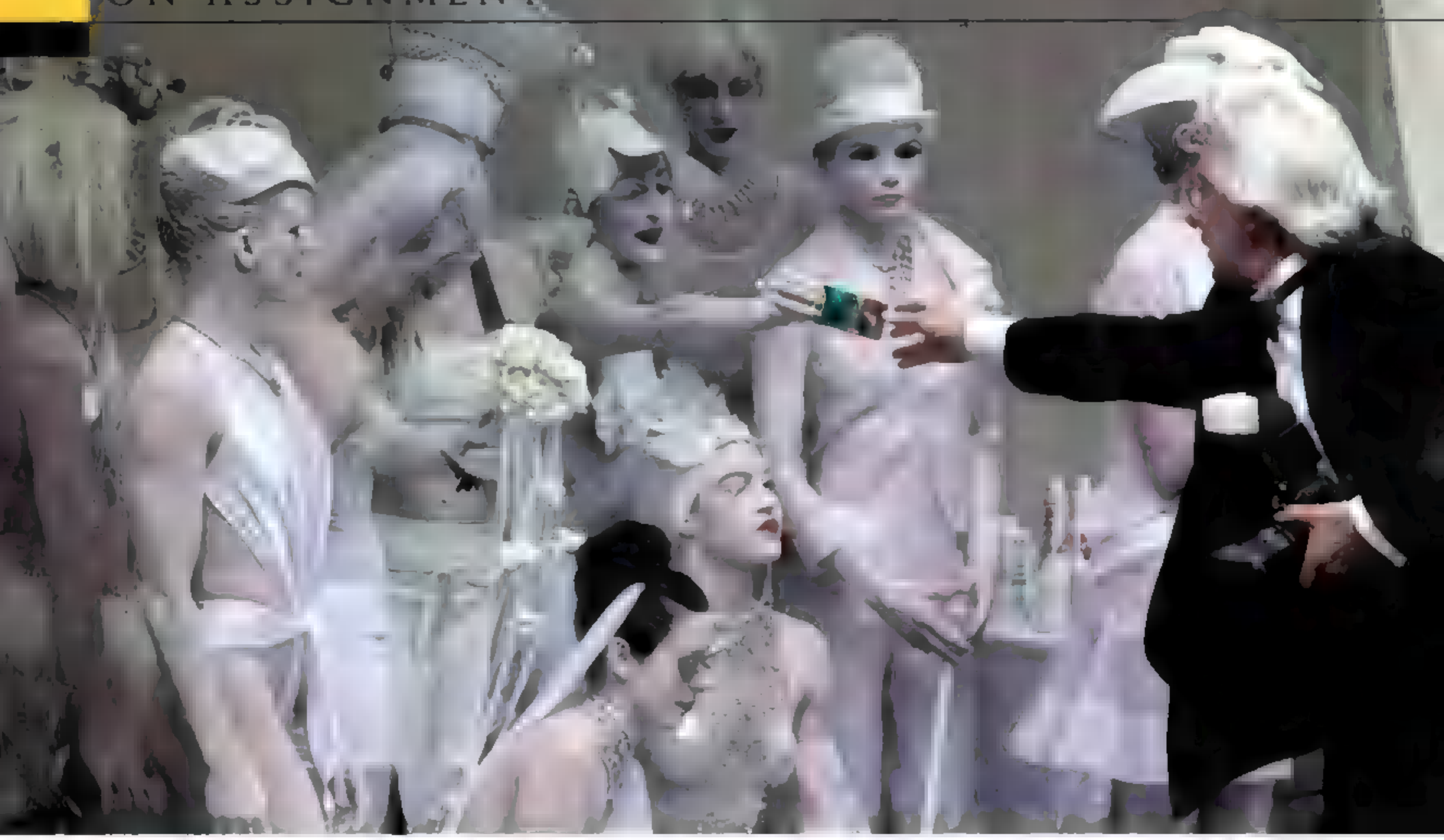

BERTRAND STOFLETH

FRANCE

My Camera or Yours?

Ah, the glamour of it all! Photographing a troupe of dancers sporting one-of-a-kind diamond necklaces at an AIDS benefit during the Cannes Film Festival, **Cary Wolinsky** faced a barrage of requests: All the dancers wanted him to take their pictures with their own point-and-shoot cameras. It's a request he often hears from his subjects. "More than once I have had to ask people how their cameras work," he says.

Cary photographed aspects of the diamond trade on four continents. "It was a very hard assignment," he says. But he applied his usual technique: "I research the hell out of the subject. Then I get on a plane and hope that what I want to be there really is there when I arrive."

WORLDWIDE

Sporting a warm—if not perfectly fitting—hat, author **Cliff Tarpy** hauls reeds he whacked in the Danube River Delta. "It was colder than I'd expected, so my guide, Adrian Cacencu, lent me his hat," Cliff says. "One of the harvesters gave me his sickle. In 15 minutes I made a hash of it. I cut reeds unevenly; I chewed them up. And the stubble jabbed into my legs." Despite the experience, Cliff calls the delta "an undiscovered corner of Europe that deserves more attention."

Having extensive experience photographing in the Middle East and other parts of the Muslim world, **Ed Kashi** found getting around the Danube "very easy, a real pleasure." But he often was disheartened by the long-standing enmities among Danube basin peoples "who have just been through a decade of war and hatred. There's still a lot of healing that has to go on there," Ed says. "Even the people I worked with reflected the biases of the area."

Robert Caputo's work as a writer and photographer has focused on life in Africa; his article on black bears in this issue was his first assignment in the U.S. or anywhere in the developed world. "It's amazing," he says. "When you run out of something, you can go to the store and buy it. And you can walk around without worrying about an animal eating you."

ED KASHI

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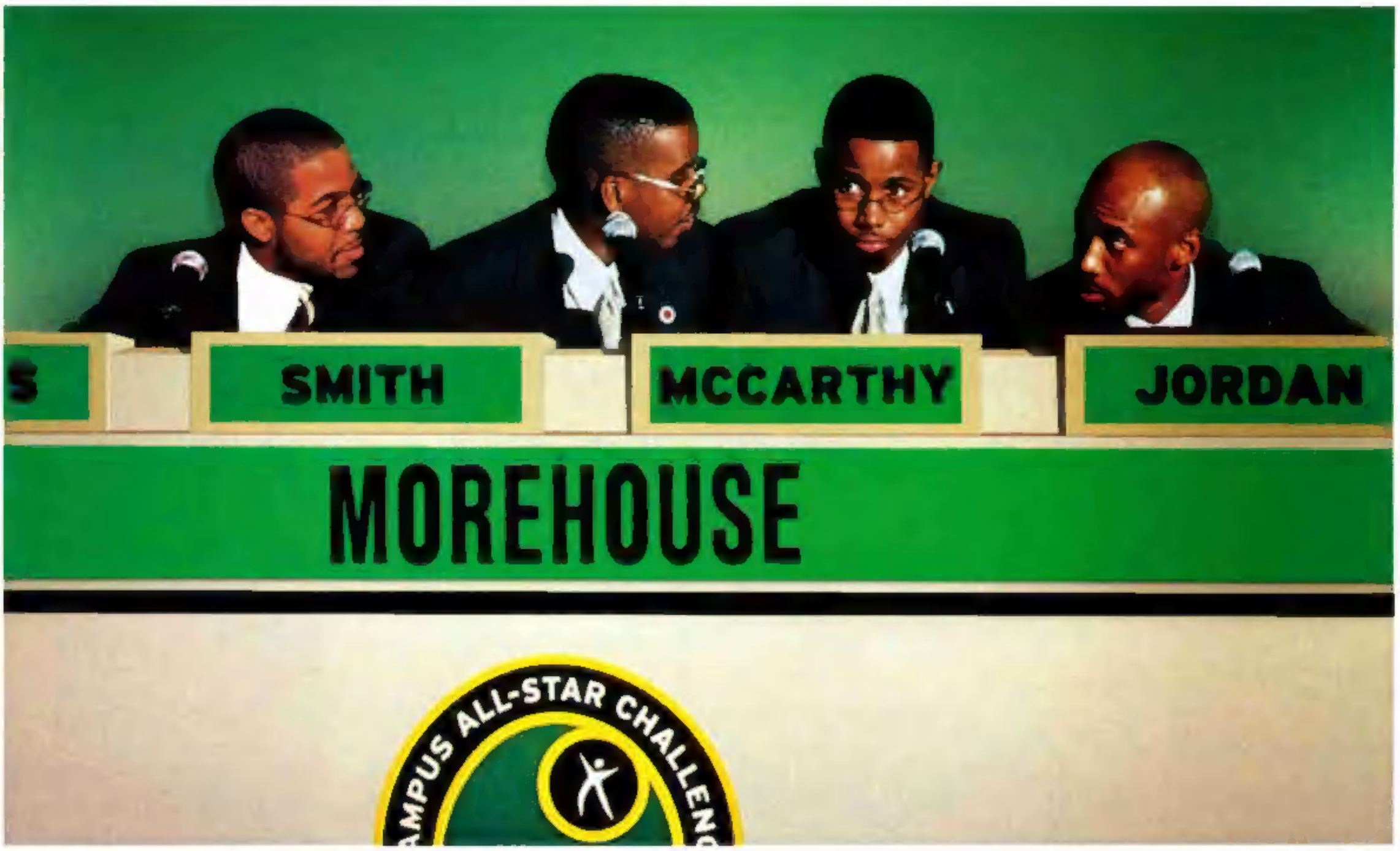

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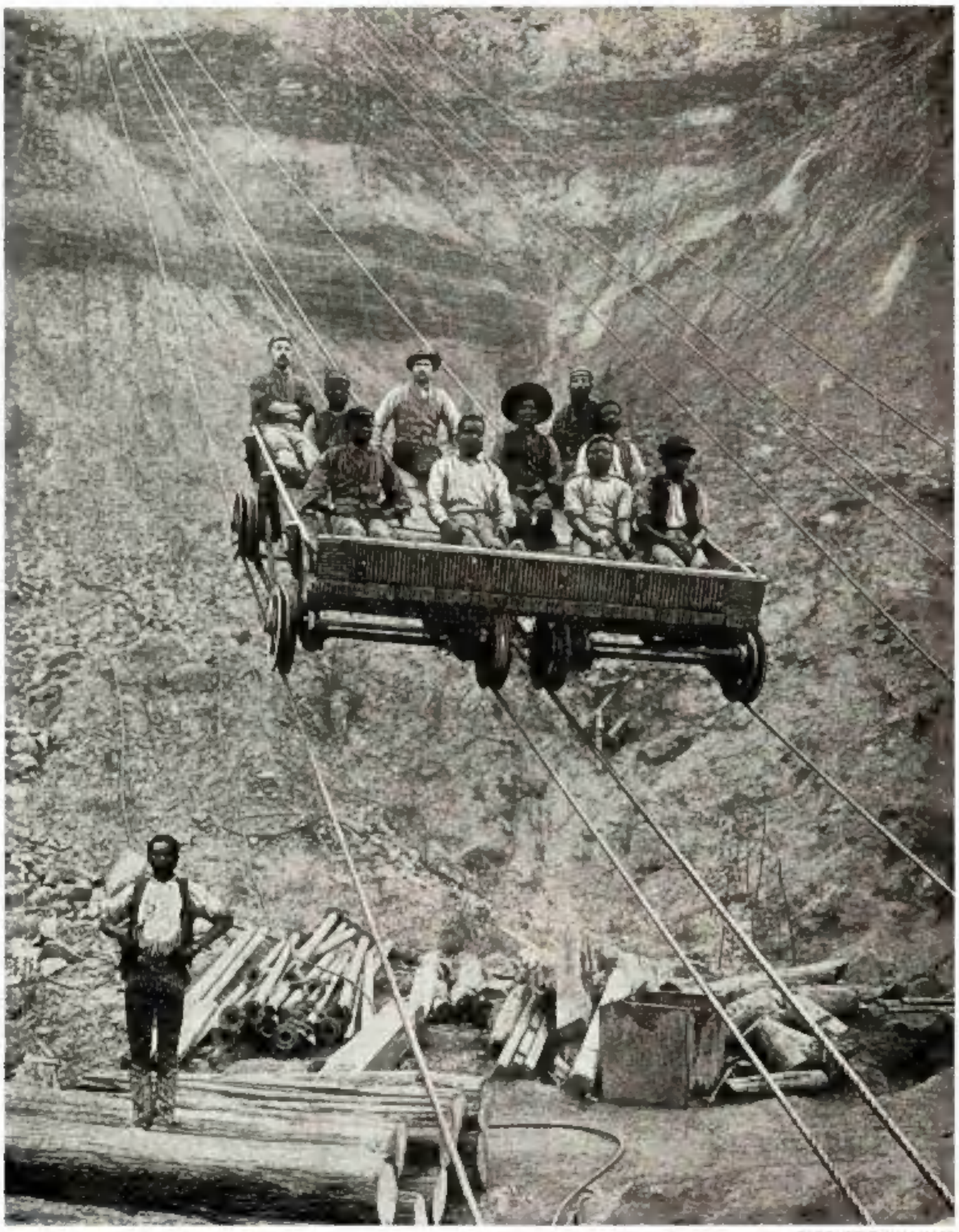
Flashback



GARDNER F. WILLIAMS

DIAMONDS

High-wire Act

Workers entering a South African mine traveled by a system of cables stretched from rim to pit floor. The tramway also served to bring diamonds up from below. "So thickly together were these lines set," wrote Gardner F. Williams in his 1905 book, *The Diamond Mines of South Africa*, "that the whole face of the vast pit seemed to be covered by a monstrous cobweb, shining in the moonlight as if every filament was a silver strand."

This photograph was first published in the magazine in June 1906.

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